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COMPREHENSIVE AREA-WIDE WATER and SEWER PLAN 1970

STATE OF MONTANA-VOLUME 16

BIG HORN, TREASURE & ROSEBUD COUNTIES

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March 12, 1971

Department of Planning and Economic Development
State of Montana
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Helena, Montana 59601

Gentlemen:

In accordance with our agreement for water and sewer planning for forty nine of the fifty six counties in Montana, we hereby submit this Comprehensive Area-Wide Water and Sewer Plan.

This report is based on engineering and planning studies made throughout the county areas. The population characteristics and trends, the economics, and the natural resources of the counties were carefully analyzed. Based on information gathered from the study and on examination of existing water and sewer facilities, recommendations for new or improved water and sewer facilities were made where applicable.

We wish to express our appreciation for the cooperation we received from the federal and state agencies we have worked with and from the administrative agencies, from the community and civic leaders, and from the residents of the counties involved.

Respectfully submitted,

Jack F. Mueller

Jack F. Mueller, PE

J Wirth

Theodore J. Wirth, ASLA

THEODORE J. WIRTH AND ASSOCIATES
ENVIRONMENTAL PLANNING CONSUTANTS
Chevy Chase, Maryland 20015
Billings, Montana 59102

MUELLER ENGINEERING
CONSULTING ENGINEERS
1629 Avenue D
Billings, Montana 59102

INTRODUCTION

The State of Montana is basically rural in nature with the vast majority of its people still living in small rural communities and there is every indication this situation will prevail for many years. It is important, therefore, to provide adequate and suitable water and sewer facilities for this rural population. It is just as important as for the larger urban areas, but this need of rural communities is often overlooked in our rapidly urbanizing society.

This Comprehensive Water and Sewer Study analyzes the present state of water supply and sewage disposal and is based on projected changes in population, economy, and land use. It projects improvements and additions required to meet needs during the next twenty years. Although the report is technical in nature, every effort has been taken to make it understandable to any interested person while retaining those details required for persons responsible for engineering these facilities. Adequate water and sewer facilities can be provided only with the active support of an informed and concerned citizenry.

While the general purpose of this study is to provide information necessary for coordinated planning of water and sewer facilities on a county wide basis, the specific aims of the study are to:

1. Develop an awareness on the part of the people of rural areas as to their water and sewer problems and needs.

2. Provide the information necessary for a concerned citizenry to be properly informed on water and sewer problems and needs.

3. Develop on the part of the people affected a desire to solve present or projected problems connected with water and waste disposal.

4. Suggest best and alternative sources of water and methods of waste disposal.

5. Prevent unnecessary duplication and underdesign or overdesign of water and sewer facilities.

6. Coordinate use of common facilities such as water supplies and waste treatment plants.

This plan encompasses all rural communities within the county containing five or more dwelling units but having a population of less than 5,500. The requirements of the Farmers Home Administration, which funded the project, and the Montana Department of Planning and Economic Development concerning water and sewer plans are satisfied by this study.

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BIG HORN COUNTY

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CONCLUSIONS, RECOMMENDATIONS, AND PRIORITIES

Conclusions

Big Horn County is expected to increase in population during the planning period. This increase is expected to take place throughout the larger communities of the county. Crow Agency is expected to experience the largest increase with Hardin, Busby, and Lodge Grass also increasing appreciably. Some of the smaller communities in the county as well as the rural areas in general will experience population decline.

The existing sewer and water systems presently in operation throughout the county are in generally good condition; however, minor repair and replacement are necessary in practically all cases. Some of the smaller communities could feasibly construct community sanitary facilities, and in some cases the improvements are very much needed. Community systems have been proposed for all communities in the county where feasible; however, in some cases the local demand for improvement has not developed.

Expansion and enlargement for some of the existing systems will be necessary where population increase is expected.

Recommendations

This plan shows the various types of improvements which the communities should be considering during the planning period. Elaborate systems are not proposed but rather those facilities necessary to provide safe and adequate community systems. It is recommended that this general plan be adopted by the governing agencies of each community. A detailed approach, which must be undertaken to insure completion of the improvements in each community, cannot be covered in a report of this type. Community leaders, however, do have several courses of action which may be taken.

Most small communities do not have the means to plan and finance complete water and sewer systems. Therefore, to enable communities to acquire such facilities, five departments of the Federal Government have legislation authorizing loans or grants for construction of public works. These agencies are:

Farmers Home Administration
United States Department of Agriculture
P.O. Box 850
Bozeman, Montana 59715

Federal Water Quality Administration
United States Department of the Interior
% Montana State Department of Health
Helena, Montana 59601

Public Health Service
United States Department of Health, Education, and Welfare
Division of Indian Health
Billings, Montana 59101

Administration for Metropolitan Development
United States Department of Housing and Urban Development
Assistant Regional Administrator
Denver Regional Office
1050 South Broadway
Denver, Colorado 80209

Economic Development Administration
United States Department of Commerce
Montana Field Coordinator
207 Medical Arts Building
Butte, Montana 59701

The legislation is constantly changing; therefore, community leaders should investigate the various alternatives and determine which program and course of action would be most beneficial to them.

Priorities

That a particular system requires immediate improvements and another system will be satisfactory for a definite period are difficult to establish. Several indicators for establishing priorities are available, however. The general health of the people is the prime consideration, and this can only be insured when safe water supplies are provided. Water supply in adequate quantities is another important factor. Waste water must be treated and disposed of by safe methods to minimize the problems of pollution and to protect public health. The total number of persons benefited by any improvement must also be considered. These basic criteria were used in establishing the following priority listing:

1. Hardin Water System. Additional water supply is a necessary improvement for this community. There is sufficient population to warrant the expansion, and the project is feasible.

2. Hardin Sewer System. The elimination of a potential pollution problem makes this project necessary. There is sufficient

population presently residing here to make the project feasible.

3. Crow Agency Sewer System. The elimination of a potential pollution problem makes this project necessary. The industrial development presently existing in the area makes the project feasible.

4. Lodge Grass Sewer System. The elimination of a potential pollution problem makes this project necessary. The number of persons residing in this community makes the project feasible.

5. Wyola Water System. Improved water supply is a necessary improvement for this community. There is sufficient population residing here to make the project feasible.

6. Wyola Sewer System. The need for improved sanitary facilities makes this project necessary, and there is sufficient population to make the project feasible.

7. Pryor Water System. The number of persons presently residing here makes the project feasible, and the anticipation of additional population makes the project necessary.

8. Pryor Sewer System. The need for improved sanitary facilities is apparent in this community. The present as well as future populations of the community indicate that the project is feasible.

9. Crow Agency Water System. Additional water supply will be necessary for this community during the planning period. There is sufficient population to warrant the construction of additional facilities.

10. Busby Water System. Additional water supply will be necessary for this community by 1990. There is sufficient population residing here to make the project feasible.

11. Busby Sewer System. Additional population increase in this community will make this improvement necessary.

This list of priorities is not intended to govern the order in which action should be taken. The order merely ranks the severity of the problems and the need for improvements.

THE LAND

General Characteristics

Big Horn County is located in the southeastern part of the State of Montana and is bounded by Rosebud, Powder River, Carbon, Yellowstone, and Treasure Counties and the State of Wyoming. The total area is 5,055 square miles of which twenty two square miles represent water surface. The Yellowtail Reservoir, Tongue River Reservoir, and Lodge Grass Storage Reservoir, and numerous rivers account for most of this water surface area.

As seen by the topography on Map 1, Big Horn County contains great variations in topography, including high mountains, deep canyons, extensive areas of rolling plateaus, and nearly level bottom lands. Elevations vary from 2,900 feet along the lower Big Horn River to more than nine thousand feet in the Big Horn Mountains with most of the agricultural land lying between the three and four thousand foot level.

Big Horn County has a relatively small population distributed mainly along the Big Horn and Little Big Horn Rivers with the county seat of Hardin as the focal point.

U. S. Highway 87 and Interstate 90 form the main north to south route through the center of the county. This federal highway travels from Sheridan, Wyoming northward to Hardin where it forks westward to Billings or northward to join Interstate 94 east of Custer in Yellowstone County. Entering the eastern border from Rosebud County, U. S. Highway 212 travels to Crow Agency and the Custer Battlefield National Monument. State Highway 47 extends north and south connecting Hardin and the community of Custer in Yellowstone County. Numerous other state secondary and county roads serve the outlying areas.

Rail transportation is provided by a branch line of the Burlington-Northern Railroad which provides freight service north and south through the county roughly paralleling U. S. 87 and Interstate 90. From Hardin, the line extends westward to Billings and southward to Wyoming.

Although no commercial airports are located within Big Horn County, Hardin has a paved 3,400 foot landing field available to the public. Minimum servicing facilities are available at the site. An unpaved, 3,500 foot airstrip for public use without any facilities or services is also available at Hardin. There is a paved air field at Yellowtail Dam, but this field is restricted and not intended for full public access. Daily air service and connections to nation wide airlines are available at Billings or at Sheridan, Wyoming.

There are several suppliers of electrical power in Big Horn County. Major transmission lines of the United States Bureau of Reclamation, the Pacific Power and Light Company, and the Montana Power Company all cross areas of the county. Together with Bureau of Reclamation and Pacific Power and Light Company substations at the Yellowtail Dam power plant, Hardin also is the site of major switching and substations that distribute to local areas. The Big Horn Electric Cooperative, Inc. further distributes power locally with the main office at Lodge Grass.

Telephone service to the county is provided by three telephone companies and one cooperative. The Mountain States Telephone Company serves the central area and the towns of Hardin, Fort Smith, Lodge Grass, and Wyola. Project Telephone Company serves the extreme northwestern corner while the northeastern corner is served by the Hysham Telephone Company. Range Telephone Cooperative provides service to the southeast part of the county serving the towns of Decker, Quietus, Kirby, and Busby.

Land Ownership and Use

As seen on Chart 1, there are four classes of landowners in Big Horn County. The largest segment of land, forty nine percent or 2,494 square miles, represents the Crow Indian Reservation. The federal government owns 724 square miles, or fourteen percent. Thirty four percent, 1,693 square miles, is under private ownership while the remaining three percent is state held land.

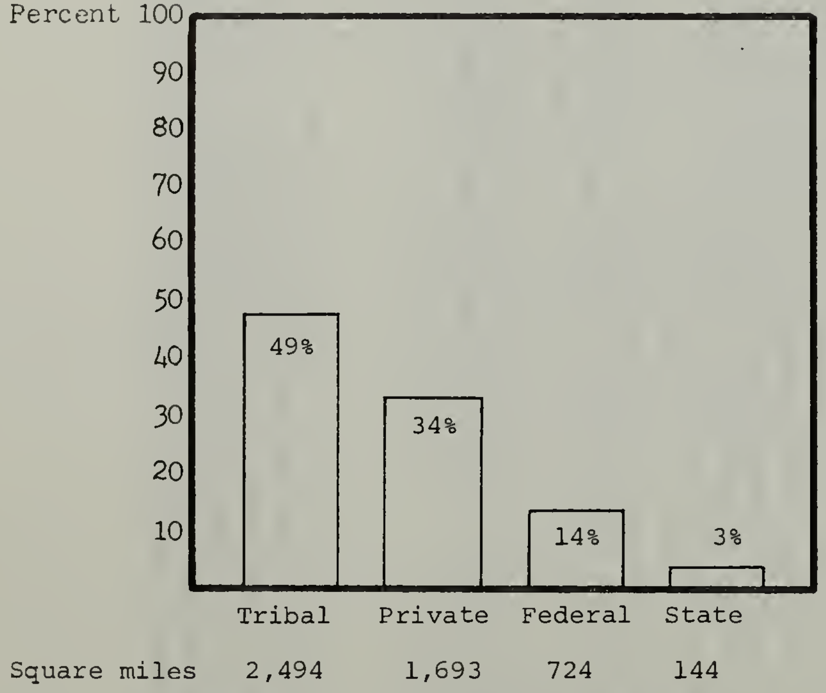
The land use pattern generally reflects the physical characteristics of the county. Agricultural uses occupy eighty five percent of the land, thus reflecting the suitability for farming. Forest and commercial uses each represent six percent of the total while other uses, including water surface areas, land used for transportation routes, town sites, and other non agricultural uses represent the remaining three percent.

Natural Resources

Although Big Horn County is chiefly an agricultural county, there is an abundance of natural resources within its boundaries. Crude petroleum production since 1952 has prospered into four producing oil fields and ranks as the number one natural resource of economic importance to the county. Soap Creek Field is the largest with a

CHART 1

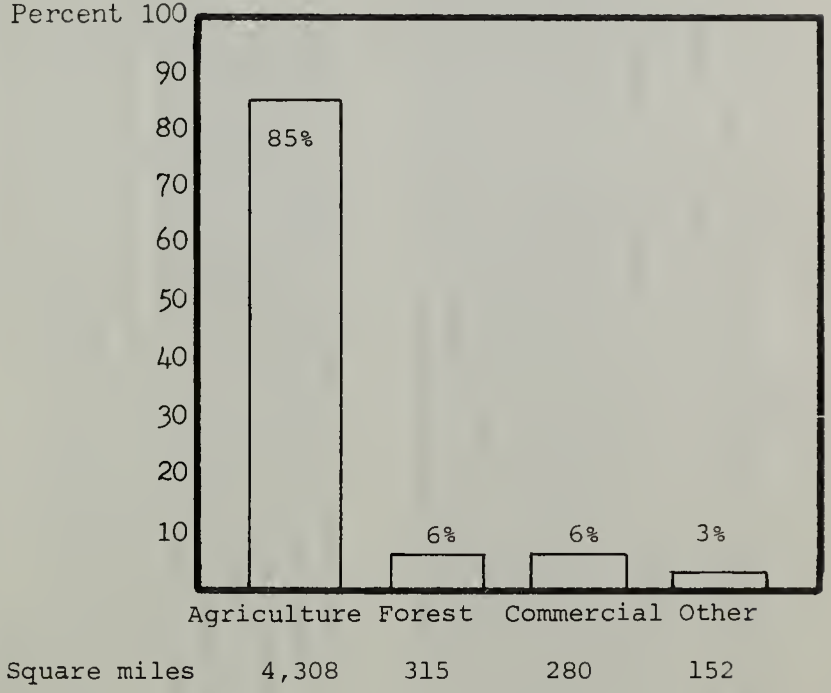
Land Ownership
Big Horn County



Source: The Montana Almanac, 1959-60

CHART 2

Land Use
Big Horn County



total production of 63,555 barrels in 1968. Ash Creek, Lodge Grass, and Snyder are smaller fields and had a combined total of 72,594 barrels in 1968.

Another mineral fuel, coal, contributes to the economy of the county. Most of the coal is in the eastern part of the Crow Indian Reservation. The majority is mined from the Tongue River Mine in the Fort Union formation. The bituminous rank coal beds range from one to twenty four feet in thickness.

Lime, stone, sand, and gravel are nonmetal resources found throughout the county. Lime is used in the refining and manufacturing of sugar produced at the Holly Sugar Corporation plant at Hardin. In 1964 sand and gravel production was at a 1.2 million ton volume mainly because of the construction work at the Bureau of Reclamation Yellowtail Dam project. Since that year, sand, gravel, and stone have decreased in output and are now principally demanded for local needs such as road repair or residential building construction.

Since the 1800's when cattlemen arrived, agriculture has remained the mainstay of the county's economy. Wheat is the main crop presently harvested in the area, and in 1967 the value of the produced crop was 3.7 million dollars. Big Horn County also produces a tremendous amount of livestock and livestock products which totaled a sale price of 9.3 million dollars in 1967.

Excellent recreational opportunities exist in Big Horn County. Important attractions are the Custer Battlefield National Monument at Crow Agency and old Fort C. F. Smith near the mouth of the Big Horn Canyon. Other historic memorials, such as the Chief Plenty Coups Memorial State Monument and the Reno-Benteen Battlefield Memorial can also be visited in the county. Swimming, boating, and fishing are a few of the numerous out of doors activities offered to county residents and their guests, and ideal facilities are located at the Afterbay Recreation Area at Yellowtail Dam. The Lodge Grass Reservoir and Tongue River Reservoir are also excellent camping, hiking, picnicking, and water sport areas. Big game and upland game bird hunting challenge the outdoorsman. Antelope, deer, sage grouse, sharptail, and Hungarian partridge are all found on the rolling hills and plain areas of the county.

Soils

Because of the climate and topography of Big Horn County, the soils are particularly suitable for crop and grazing lands. A large volume of dryland wheat production and diversified irrigation farming is found throughout the county. The dryland wheat production is largely located on bench lands or plateaus which have soils of good water holding capacity.

Soils are covered in more detail later in this report.

Water

All drainages of Big Horn County are part of the Yellowstone River watershed. The lower Big Horn River and its tributaries, of which the Little Big Horn River is the largest, form the principal drainage. Pryor Creek drains the west side, and the east side is drained by Tullock and Rosebud Creeks and the Tongue River. Irrigation is an expanding factor of great importance enhanced by the recent construction on the Big Horn River of Yellowtail Dam and the proposed subsequent canal system.

Water resources are covered in more detail later in this report.

THE PEOPLE

Population

For analytical and projective purposes, it is necessary to study the population history of Big Horn County to find out what has happened and what is going to happen. Chart 3 graphically shows the growth of the county as compared with that for Montana and indicates the future growth for both.

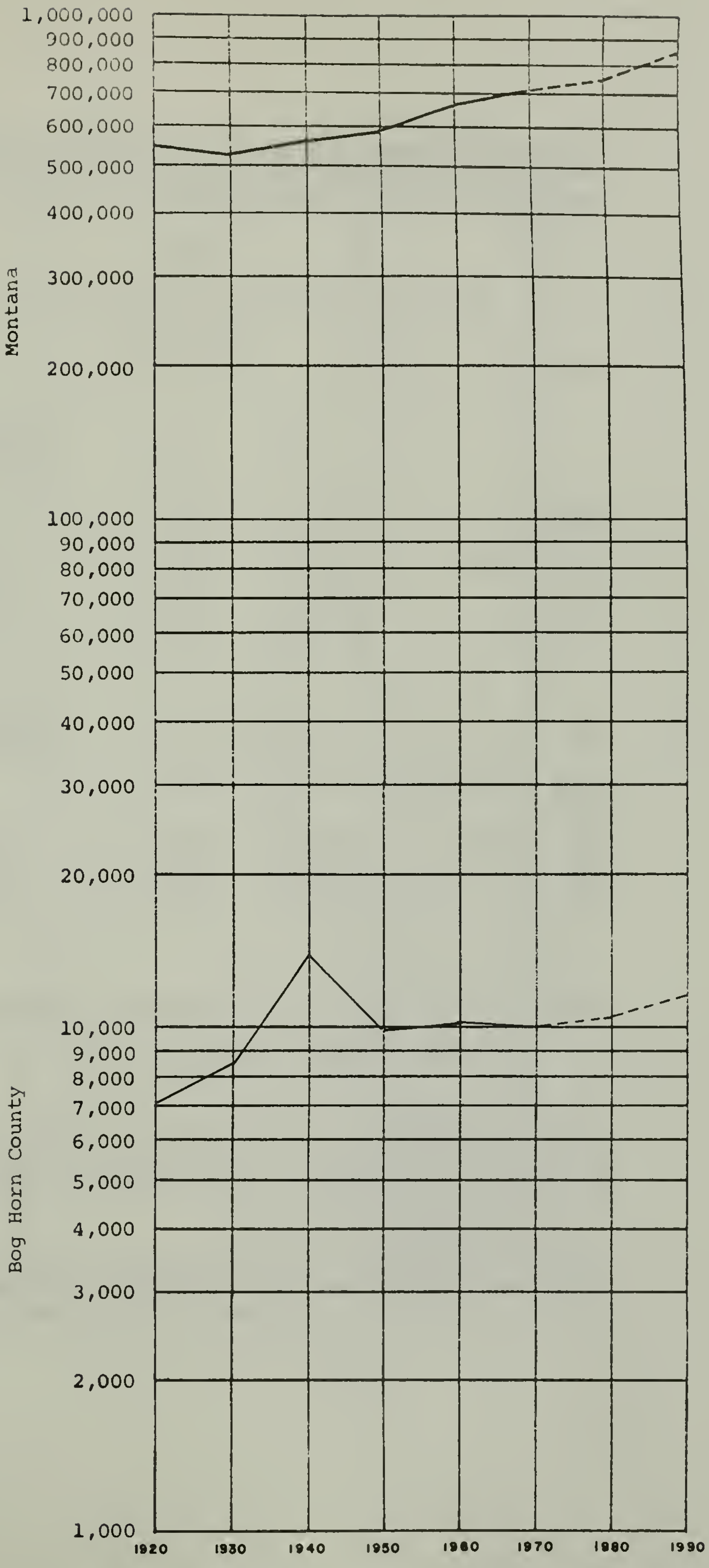
Population in the county has generally been on the rise since 1920. Since that time there have been two periods when slight decreases occurred. A twenty percent increase occurred during the 1930's when other Montana counties experienced population losses. The estimated 1970 population is 143 percent higher than in 1920, and the projected 1990 population increases to 164 percent.

The county was classified as a peripheral metropolitan or suburban place in 1960 in that it was adjacent to but not a part of the Billings Standard Metropolitan Statistical Area. Table 1 indicates the population changes for the urban, farm, and rural non farm areas of the county. For each ten year period from 1950 to 1970 the urban population increased while its rural counterpart declined in total numbers. The farm population accounted for all rural losses. The rural non farm population increased throughout the twenty year reporting period. The farm population represented forty three percent of the total population in 1950 and dropped to thirty two

CHART 3

COMPARATIVE POPULATION TRENDS

Big Horn County and Montana



Sources:

1. U.S. Census of Population
2. Intermountain Planners, Inc.

percent in 1960 and to twenty five percent in 1970. During that time both the rural non farm and the urban populations increased as a percent of the county wide population.

TABLE 1

Urban-Rural Population Changes for Big Horn County

1950-1970

	1950	1960	Changes Number	1950-1960 Percent
Total	9,824	10,007	+183	+ 1.9
Urban (Inc. Towns)	2,842	3,476	+634	+22.3
Rural	6,982	6,531	-451	- 6.5
Farm	4,181	3,243	-938	-22.4
Non Farm	2,801	3,288	+487	+17.4

	1960	1970	Changes Number	1960-1970 Percent
Total	10,007	10,000	- 7	- 0.1
Urban (Inc. Towns)	3,476	3,650	+174	+ 5.0
Rural	6,531	6,350	-181	- 2.8
Farm	3,243	2,500	-743	-22.9
Non Farm	3,288	3,850	+562	+17.1

Sources: 1. U. S. Census of Population, 1950-1960

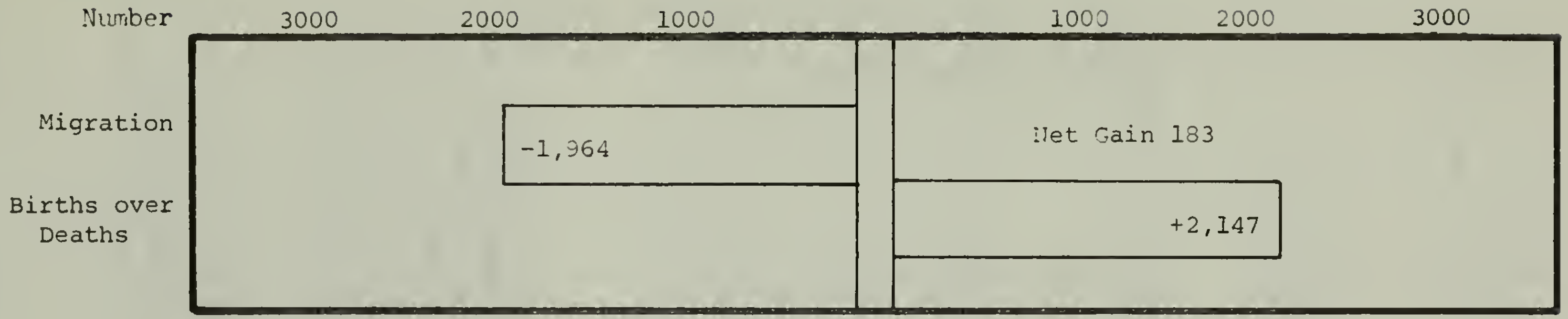
2. Intermountain Planners, Inc.

During the period from 1950 to 1960 the number of persons in the county increased by 183. Chart 4 indicates that the population gain is a result of an excess of 2,147 births over deaths and a net migration loss of 1,964 persons.

The 1950 to 1960 change in sex composition is shown in Chart 5. As shown, the ratio between males and females was smaller in 1960 than in 1950. No change is expected to occur throughout the twenty year

CHART 4

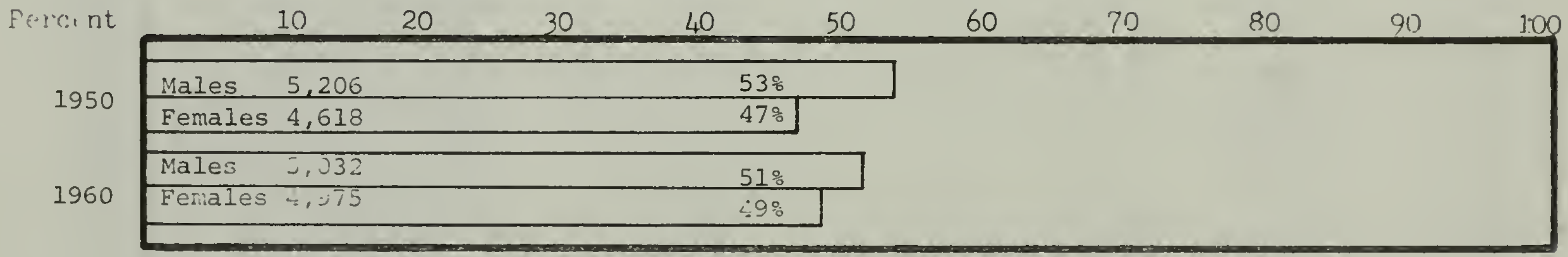
Population Change
Big Horn County 1950 - 1960



Source: Net Migration of Population, 1950-1960 by Age, Sex, and Color, U. S. Department of Agriculture

CHART 5

Population by Sex
Big Horn County 1950 - 1960



Source: U. S. Census of Population, 1950-1960

planning period.

The age distributions by sex for 1950 and 1960 are shown in Table 2. As indicated, growth occurred within the younger and older age groups.

TABLE 2

Age & Sex Composition of Big Horn County

Age Group	1950 Male	1950 Female	1960 Male	1960 Female
Under 5	674	688	664	734
5-14	1,111	1,021	1,195	1,226
15-19	405	370	416	432
20-24	366	330	282	322
25-34	710	703	581	573
35-44	669	550	578	585
45-54	480	395	554	441
55-64	396	316	383	302
65-74	280	165	240	241
75 +	115	80	139	119
Total	5,206	4,618	5,032	4,975

Source: U. S. Census of Population, 1950-1960

A total of nine towns and communities were studied in Big Horn County. The list includes the two incorporated towns of Hardin and Lodge Grass and the seven unincorporated communities of Busby, Crow Agency, Decker, Fort Smith, Pryor, St. Xavier, and Wyola. The communities of Kirby and Garryowen were also studied but not included in this study because of insufficient population and development. The community of Yellowtail, located near Fort Smith, was also excluded because it is a government maintained construction camp for workers on Yellowtail Dam.

Hardin will remain the major urban area in the county throughout the twenty year planning period. The population will increase by about four hundred persons during the period, a fourteen percent gain. The increase in the number of persons will necessitate the addition of about one hundred new dwelling units throughout the period. The majority of the development will occur north of the community on both sides of the interchange. Residential growth will also occur in the area west of Mitchell Street and south of Third Street.

The number of persons in Crow Agency will increase by almost half by 1990. The increase will be accommodated by the construction of just under one hundred new dwelling units. The growth areas will generally be west of the railroad tracks and north of town by the school. Some development will also occur in the southeast area of the community.

The population of Busby will increase from 350 to five hundred persons by 1990. An additional forty homes will need to be built to house the additional numbers. Development will occur southwesterly of the community with some minor growth northwest of town.

Growth will also take place in Lodge Grass and in Pryor. New development will generally occur within the boundaries of the existing communities.

No population gain is forecast for the communities of Decker, Fort Smith, St. Xavier, and Wyola.

These population figures reflect only those factors and trends for which information is available. New technological advances, new industries, or other unforeseen events may alter these projections. If such an event occurs, the areas affected should be studied in light of the new conditions.

Housing

There were 2,842 housing units in Big Horn County in 1960 of which one third were in the urban areas and just over one fourth were in the farm areas; according to Chart 6, forty one percent were located in rural non farm areas. The median housing unit size was 4.10 rooms per unit, and the median household size was 3.92 persons per occupied unit. More than half of all units were owner occupied while thirty seven percent were used for rental purposes. Chart 7 indicates that eleven percent were vacant. The condition of housing in 1960 is reflected in Chart 8. Nine percent of all homes were in need of replacement while one in four needed repair. The remainder were classified as sound.

Chart 9 reflects the 1960 status of housing units in terms of source of water, water supply, and method of sewage disposal. For geographical reference, the data shows the status for Big Horn County as a whole and for the urban, rural non farm, and farm areas.

HOUSING
Big Horn County 1960

Chart 6
Housing Classification

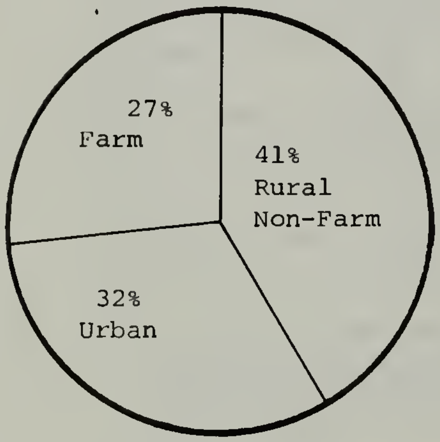


Chart 7
Housing Tenure

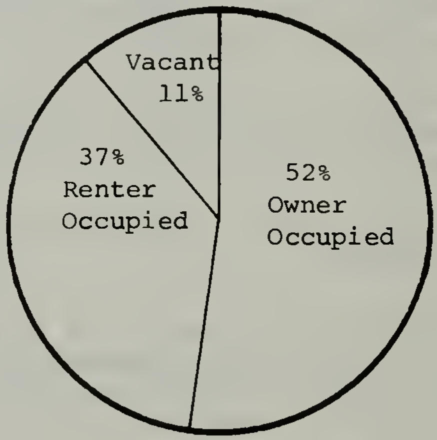
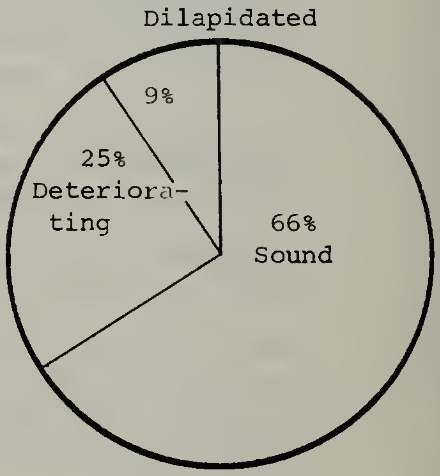


Chart 8
Housing Condition



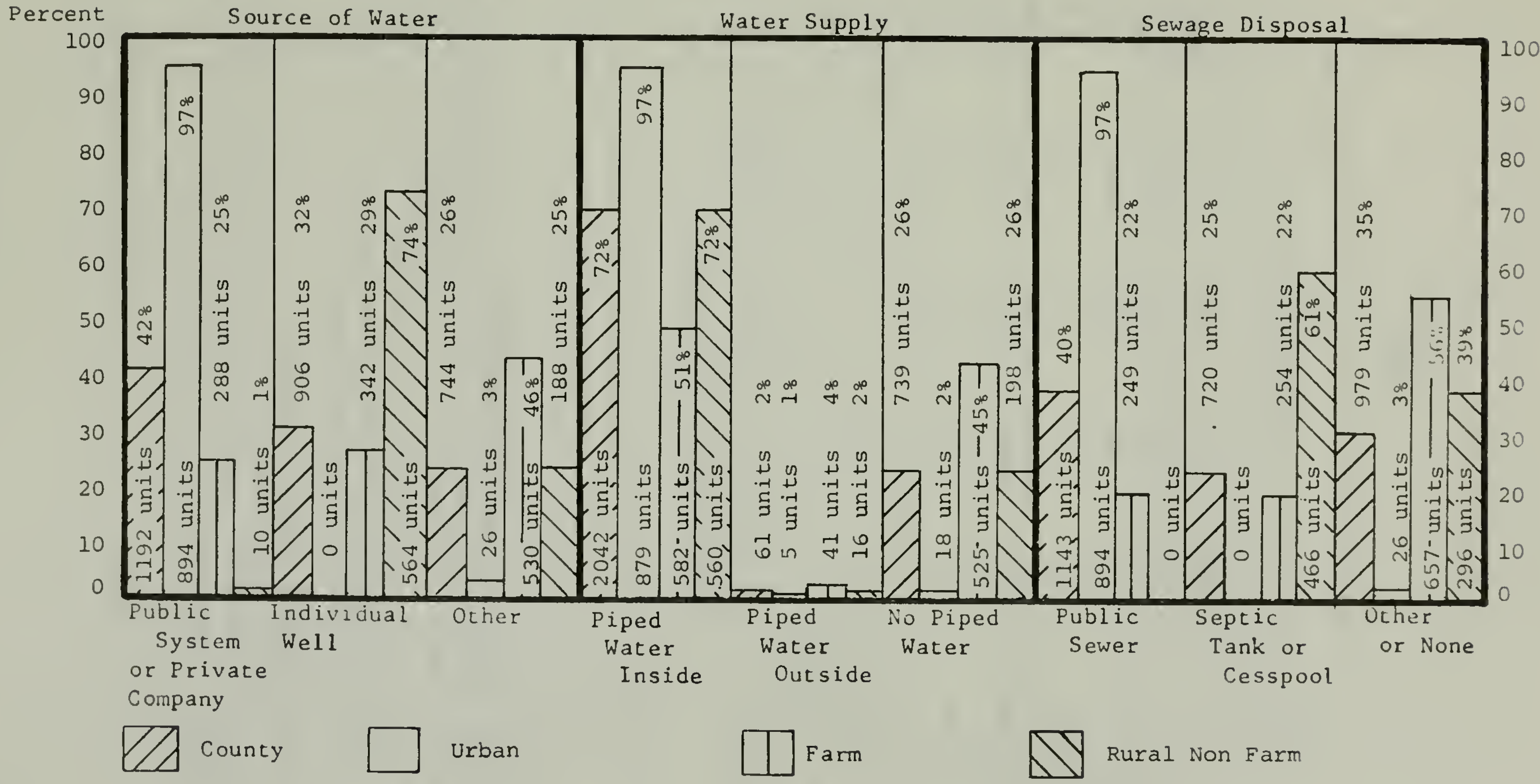
Source: U. S. Census of Housing, 1960

Less than half of all homes in the county received water by a public or private water system in 1960. Those served included almost all of the urban homes, mainly located in Hardin, one fourth of the rural non farm homes, and one percent of the farms. Generally, farms relied on individual wells for water as did about one third of the rural non farm homes. Almost half of the homes in the last category relied on a source other than a water system or individual wells.

About one fourth of all homes did not have piped water in 1960. The figure included just less than half of the rural non farm homes and about one fourth of the farms.

CHART 9

Sewer and Water
Big Horn County 1960



Source: U. S. Census of Housing, 1960

TABLE 3

Population Forecast for Towns and Communities

Big Horn County

	1950	1960	1970	1975	1980	1990
Busby	100	300	350	375	400	500
Crow Agency	500	600	750	800	900	1,100
Decker	20	5	20	15	10	5
Fort Smith	NA*	200	80	50	25	75
Hardin	2,306	2,789	2,900	2,975	3,050	3,300
Lodge Grass	536	687	750	775	800	825
Pryor	65	50	100	110	120	150
St. Xavier	75	100	60	55	50	30
Wyola	87	100	130	110	100	75

---

* Not available

Sources: 1. U. S. Census of Population, 1950-1960

2. Intermountain Planners, Inc.

Almost all homes in Hardin were connected to a public sewer and with some rural non farm homes represented about forty percent of all homes so served in the county. The farms generally relied on septic tanks or cesspools for disposal as did one fifth of the rural non farm homes. One third of all homes, including fifty six percent of the rural non farm homes and thirty nine percent of the farms, used still another source for sewage disposal.

The housing data indicates an adequacy of services in the urban areas. The rural non farm areas, mainly represented by urban areas on the Crow Reservation, were substantially lacking in adequate facilities. Efforts need to be directed to these areas.

THE ECONOMY

Labor

The economy of Big Horn County is dependent on the people because of their role as both producers and consumers of goods and services. The following economic analysis is concerned primarily with the total economic spectrum and how it may affect the future of the area. Changing economic conditions can have either a good or a bad effect in terms of population growth, ability to provide for public improvements, or in determining the general overall living environment.

From 1950 to 1960 employment in the county fell by six percent while the population increased by almost two percent. During the same period employment for the state increased by six percent.

Employment change by major industry groups is shown in Chart 10. Because of an adequate shrinkage in the male labor force, the unemployment rate between 1950 and 1960 expanded to the highest level found in southeastern Montana. Four fifths of the job closings occurred in the agriculture group while construction and trade accounted for an additional ten percent. In contrast, services and finance contributed over half of all new positions while manufacturing was responsible for a fifth of the additions. Most of the latter gain was in food processing.

The county is situated within the Billings market area where goods and services are provided the residents of the county. Partial shopping facilities are available in Hardin, but selection goods and most services are located fifty miles to the north in Billings.

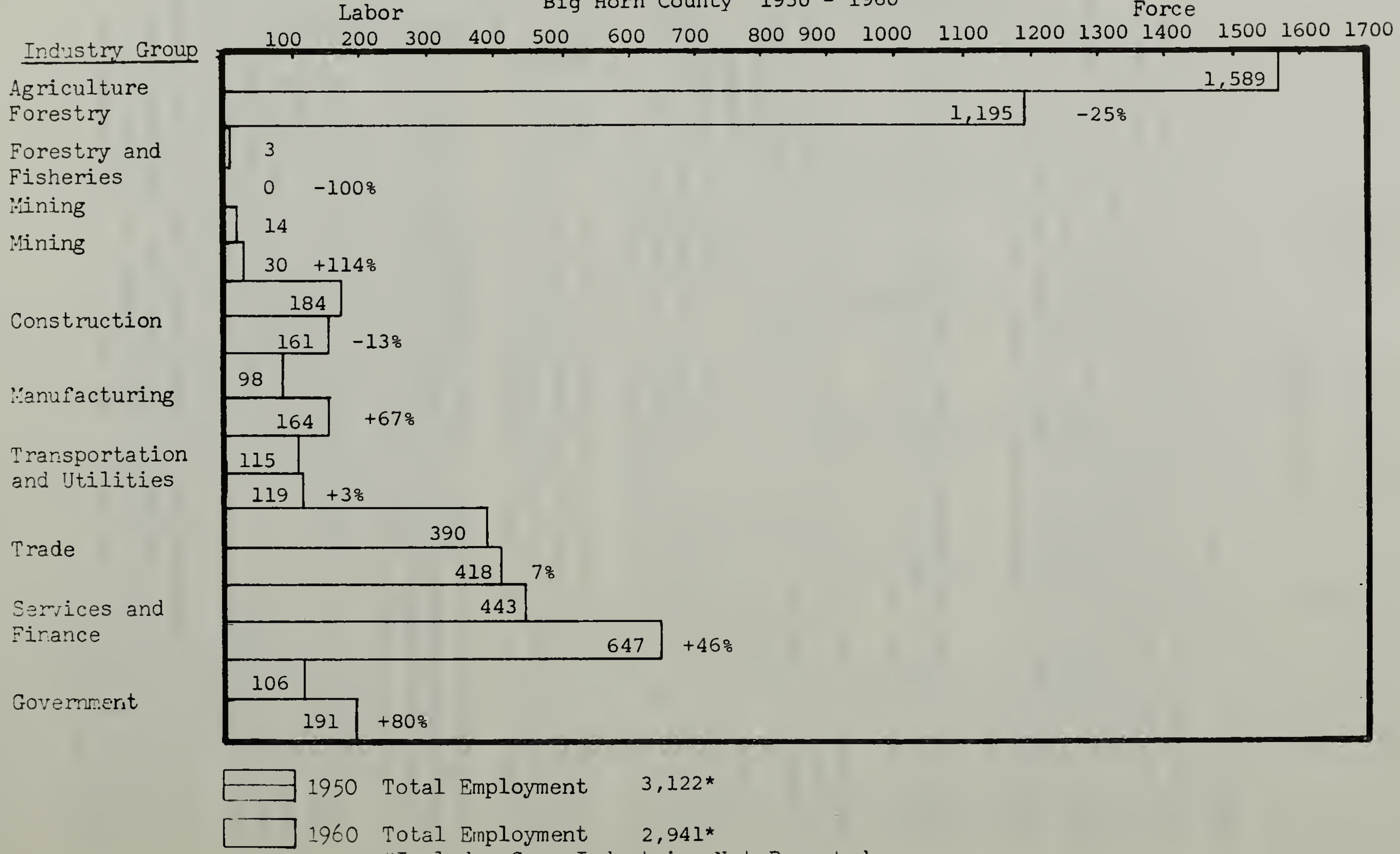
About one third of the trade group was employed in eating and drinking establishments, and one tenth of all workers were in the grocery store business. Just over half of all workers in this group were in retail sales employment.

Only ten percent of the total services and finance employment represented personal services while eight percent were in finance, insurance, and real estate. Over one third of the employment in the group was in education and only one worker in seven represented professional services.

Percentages for employment by industry group shown in Table 4 provide an insight into local employment characteristics. The table shows the relative weight of each group in the county and offers a comparison with that existing in 1960 for the State of Montana and the United States.

CHART 10

Employment Change by Major Industry Group
Big Horn County 1950 - 1960



Source: U. S. Census of Population, 1950–1960

TABLE 4

Percent of Total Employment by Industry Groups

Big Horn County, Montana and United States

1960

	Big Horn County	Montana	United States
Agriculture	41	17	11
Forestry and Fisheries	0	1	1
Mining	1	3	1
Construction	5	7	5
Manufacturing	6	10	27
Transportation and Utilities	4	9	7
Trade	14	21	19
Service and Finance	22	26	16
Government	7	6	13
Total	100	100	100

Source: U. S. Census of Population, 1960

The economy of the county is very heavily agriculture oriented. Forty one percent of all employment occurred in that group in spite of a twenty five percent decline from 1950. The local employment rate was two and one half times that for the state and almost four times that for the nation.

The dependency of the local economy on Billings is seen in the employment rate for the trade and the services and finance industry groups. Both had rates well below those recorded for Montana.

Government employment was at a rate about seventeen percent above that in the state. The Indian reservation and its accompanying federal employees are mainly responsible for this employment level.

Employment statistics for 1969 as published by the Employment Security Commission of Montana indicate a general reduction in the labor force over that reported in 1960. A 128 percent employment gain is noted in the mining group, an increase due primarily to crude oil exploration operations in the county.

More agriculture acreages will be irrigated for the first time because of the completion of Yellowtail Dam. Higher farm incomes will probably occur, adding to the local economy.

Agriculture

The United States Census defines a farm as a place having at least ten acres of land devoted to agriculture and selling at least fifty dollars worth of agricultural products annually. According to Chart 11, there were 588 farms in Big Horn County in the above category in 1964, five percent fewer than there were in 1959.

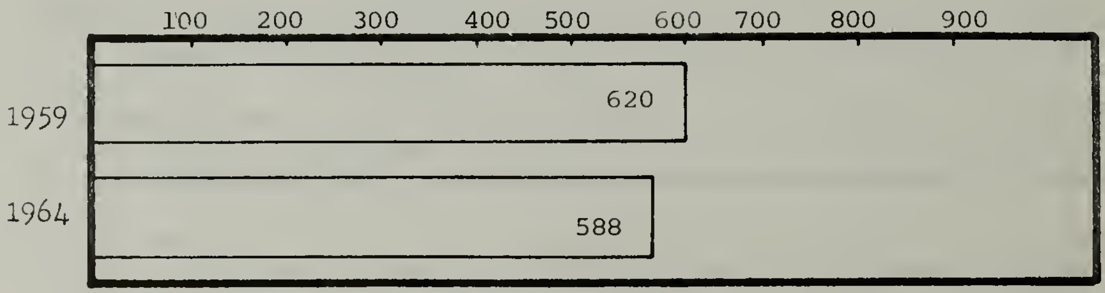
The 1964 classification of farms by type was as follows:

Field crop farms other than vegetables, nuts, and fruit		158
Cash grain	70	
Other field crops	88	
Poultry farms		1
Dairy farms		5
Livestock farms other than poultry and dairy		298
General farms		64
Miscellaneous and unclassified		62
Total		588

Of the total number of farms, thirty eight were classified as part time, and eighteen were classified as being operated by semi retired

CHART 11

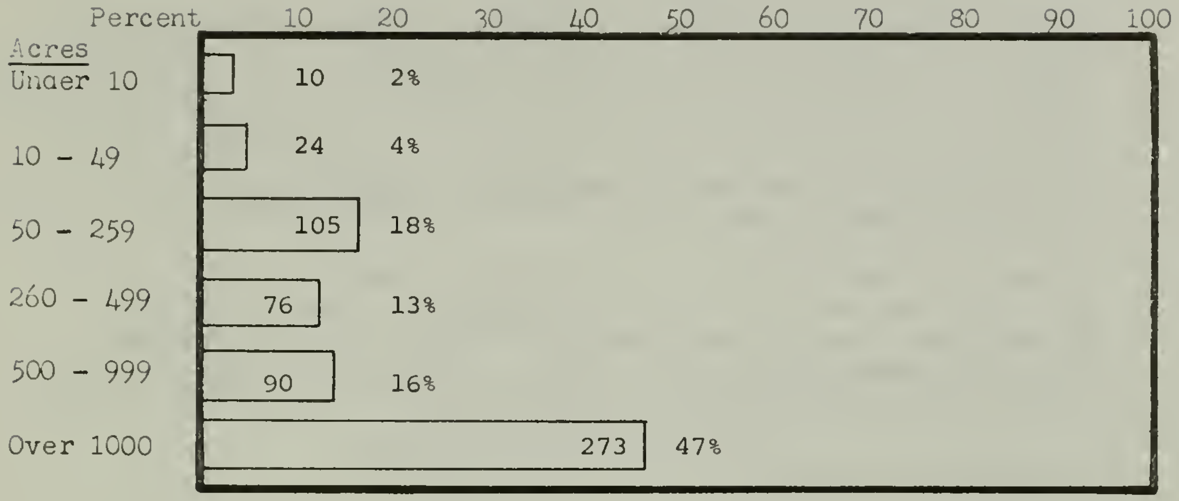
Number of Farms
Big Horn County 1959 - 1964



Source: U. S. Census of Agriculture, 1964

CHART 12

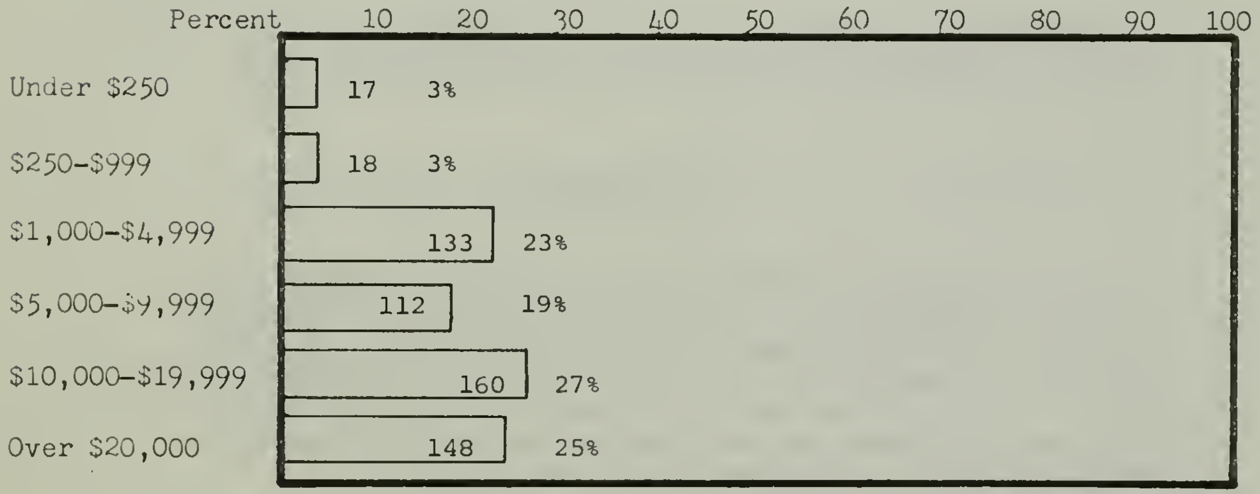
Farms by Size
Big Horn County 1964



Source: U. S. Census of Agriculture, 1964

CHART 13

Number of Farms by Value of Farm Products Sold
Big Horn County 1964



Source: U. S. Census of Agriculture, 1964

persons.

In 1964 half of all farms were primarily livestock producers while about one farm in four raised field crop products. One fifth of the farms were unclassified or general in nature while one tenth were not in full production. The average farm in that year was 4,095 acres in size, and Chart 12 indicates that just under half of all farms were larger than one thousand acres. More than one third of the total number of farms were under five hundred acres.

The value of products sold by the number of farms is seen in Chart 13. More than half of the farms received in excess of $10,000 for the sale of agricultural products in 1964. One farm in four reported incomes greater than $20,000. Less than one third of the farms reported gross receipts under $5,000.

Cash receipts from 1964 to 1967 are as follows:

Year	Livestock	Crops	Total
1964	$6,563,800	$5,839,600	$12,403,400
1965	$8,429,400	$4,577,200	$13,006,600
1966	$9,974,300	$5,475,700	$15,450,000
1967	$9,324,500	$6,669,200	$15,993,700

In 1964 the sale of livestock products represented just over half of all agricultural products sold. Throughout the four year period the ratio of livestock sales to crop sales increased, indicating the importance of animals in the agricultural industry.

As more land is irrigated, agriculture is expected to take on greater importance. Feed lots should become more prevalent with the greater demand for beef products.

THE GOVERNMENT

Before any meaningful consideration can be given to major capital improvement projects, it is necessary to study the governmental organizations in Big Horn County and to analyze their economic structure. At present there are three separate, local governmental units in the county involved within the scope of the water and sewer study. Included are the incorporated cities of Hardin and Lodge Grass and the government of Big Horn County.

A Board of County Commissioners presided over by a chairman governs the county. The incorporated municipalities are governed by a mayor council form of government.

In financing capital improvement projects, the incorporated municipalities have power to bond and raise the necessary monies for funding projects. The unincorporated small towns do not have similar power and, therefore, must rely on financing projects through the county government.

Table 5 indicates the financial condition of each unit of government in 1969.

TABLE 5

Financial Status of County Government and Incorporated Cities

Big Horn County 1969*

	Revenue	Expenditures	Assessed Valuation
Big Horn County	$3,749,541.10	$3,720,503.28	$46,043,607.00
Hardin	270,511.52	260,128.68	8,613,513.00
Lodge Grass	31,579.47	29,753.37	863,341.00

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* There are several methods presently available to communities for financing water and sewer systems:

1. Incorporated Cities and Towns may use Municipal Bonds, Municipal Revenue Bonds, and Special Improvement District Bonds.
2. Unincorporated Towns may use Rural Special Improvement District Bonds and County Water and Sewer District Bonds.
3. Incorporated Cities and Towns and adjacent unincorporated areas may use Metropolitan Sewer District Bonds.

Source: Information received from each governmental unit

THE WATER RESOURCES

General

The water resources of any area are one of its most important assets. Montana is fortunate in that water is in abundant supply over much of the state. This is especially true in the mountain areas and along the major drainages. Water is essential for many human needs with individual consumption and sanitation being foremost. Industrial and agricultural uses of water are perhaps next most important. The recreational use of water has also become a significant factor in modern day living.

In his use of this resource, man in the past has polluted much of the available fresh water and degraded it to the point where it is unfit for many or all uses. Careful planning for the efficient use of water resources can avert inconveniences caused by pollution.

Water resources, therefore, are an important consideration in the comprehensive planning for community water and sewer systems. In the following portion of this report the existing water resources of the planning area will be briefly reviewed. The discussion will be specifically concerned with the occurrence and availability of both surface and ground water. Also important, and included in Appendix I, are the specific laws and policies of the State of Montana concerning surface and ground-water resources. "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" adopted by the State Department of Health are discussed in detail. Table A in Appendix I outlines present day water quality standards as set forth by the United States Health Service.

Surface-Water Resources

Big Horn County has an extensive drainage system which has primary characteristics of both plain and mountain topography. The county is bordered on the south by mountainous terrain consisting of portions of the Pryor Mountains, the Big Horn Mountains, the Wolf Mountains, and the Rosebud Mountains. Elevations in excess of nine thousand feet above sea level occur in the Big Horn Mountains near the Wyoming-Montana border in southern Big Horn County; whereas, an elevation of less than three thousand feet occurs along the Big Horn River where it leaves the county north of Hardin.

The major drainage features of the county are the Big Horn and Little Big Horn Rivers. The Big Horn River heads in Wyoming and enters Montana through Big Horn Lake in southwestern Big Horn County.

Big Horn Lake is formed behind Yellowtail Dam which is located in the narrow Big Horn Canyon near old Fort Smith southwest of Hardin. The Little Big Horn River heads on the eastern flanks of the Big Horn Mountains near the Montana-Wyoming line and flows in a northerly direction past Wyola and Lodge Grass to its confluence with the Big Horn River at Hardin. The Big Horn and Little Big Horn River drainages provide drainage for the majority of Big Horn County. A portion of the drainage from the area north of the Pryor Mountains in extreme western Big Horn County flows north through the Pryor Creek drainage into the Yellowstone River. Also, drainage for the extreme eastern portion of Big Horn County is provided by Rosebud Creek and the Tongue River which flow in a northeasterly direction to the Yellowstone River. The Yellowstone River is the eventual recipient of all drainage from Big Horn County.

The above mentioned streams and their tributaries provide a yearlong source of water for irrigation, livestock, and domestic needs. Several of these streams have gaging stations installed by the United States Geological Survey (U. S. G. S.) where flow measurements are taken and recorded at regular intervals. Table 6 includes available data on the drainage area, discharge, and runoff for each gaging station pertinent to Big Horn County.

Many small reservoirs add significantly to the agricultural and especially the irrigational use of water in the county. As is the case in most Montana counties, there are no records for small reservoirs published by the U. S. G. S. The Montana Water Resources Board, however, has compiled and published a list of reservoirs which store fifty acre feet or more of water. Where information was available, data for privately owned dams and reservoirs was also included. Large reservoirs which are of benefit to the irrigation facilities of Big Horn County include the Big Horn Lake and Yellowtail Afterbay Dam, the Lodge Grass storage reservoir on Lodge Grass Creek southwest of the town of Lodge Grass, and the Tongue River irrigation reservoir located near Decker in extreme southeastern Big Horn County. Information regarding the details of these water storage facilities and specific data on the use of surface water for irrigation in Big Horn County can be obtained from the Water Resources Board in Helena, Montana. Also, the "Water Resources Survey" published by the Water Resources Board for Big Horn County in 1947 contains some information on the earlier use of surface water.

The climate varies from one area to another because of the wide range of topographic conditions. The effect that topography has on the climate is very important to the water resources. Prevailing west to southwest winds flowing across the high mountains provide the highest annual precipitation values. Average precipitation values at the

TABLE 6

Stream Gaging Stations

Stream	Gaging Sta. Location	Drainage Area (sq mi)	See Notes	Discharge (cfs)					Years Averaged	Runoff-(1000 Acre-Ft)			
				Max.	Date	Min.	Date	Average		Max.	Date	Min.	Date
1. Pryor Creek	At Pryor	117	1	178	6/10/68	3.4	6/24/21	*		*	*	*	*
2. Pryor Creek	Near Blgs	400	1	1,500	5/14/42	No Flow	At Times	54.8	12	65.9	1942	16.7	1940
3. Pryor Creek	At Huntley	800	1	2,300	6/5/05	No Flow	7/26/08	*	*	*	*	*	*
4. Big Horn River	Near St. Xavier	19,667	1,2	37,400	6/16/35	112	4/2/67	3,698	16	3,703	1947	1,557	1940
5. Soap Creek	Near St. Xavier	98.3	1	1,300	5/13/42	1.0	1/24/25	28.4	15	10.6	1940	34.2	1947
6. Rotten Grass Cr.	Near St. Xavier	147	1	688	6/9/68	No Flow	At Times	*	*	*	*	*	*
7. Big Horn River	Near Hardin	20,700	1	45,900	3/11/29	353	2/14/33	*	*	5,350	1924	1,280	1919
8. Little Big Horn	At State Line	193		2,730	6/3/44	21	12/27/54	147	29	146.6	1944	78.9	1950
9. Pass Creek	Near Wyola	111		1,150	6/4/44	No Flow	8/10/35	36.1	18	57.2	1944	13.0	1940
10. Little Big Horn below Pass Cr.	Near Wyola	428	1	3,630	6/14/63	12	8/8/61	197	28	215.2	1944	85.6	1940
11. Lodge Grass Cr.	Near Wyola	80.7	1	1,130	6/9/64	3.0	1/31/50	47.0	29	50.0	1944	21.1	1950
12. Little Big Horn	Near Hardin	1,294	1	4,520	4/2/65	0.20	8/7/61	251	15	234.7	1957	104.1	1954
13. Tongue River	At State Line	1,477	1,2	7,480	6/15/67	3.9	8/23/61	468	8	*	*	*	*

Stream	Gaging Sta. Location	Drainage Area (sq mi)	See Notes	Discharge (cfs)					Years Averaged	Runoff-(1000 Acre-Ft)			
				Max.	Date	Min.	Date	Average		Max.	Date	Min.	Date
14. Tongue River	Near Decker	1,770	1,2	7,340	6/15/67	0.5	4/17/40	435	29	554.0	1944	144.6	1940

Source: U. S. Geological Survey Water Supply Papers and "Surface Water Records of Montana"

Notes:
1. Irrigation diversions occur above this station
2. Flow is regulated by one or more reservoirs

* Not Recorded

lower elevations in north central Big Horn County are considerably less.

As an example of the net effect of these conditions, a precipitation measuring station at Yellowtail Dam on the north flank of the Big Horn Mountains recorded a 1969 precipitation total of 20.06 inches. Figures on the order of twenty inches per year are considered normal for the mountainous area of southern Big Horn County. Average annual precipitation values in northern Big Horn County, on the other hand, range from 11.58 inches at Foster to just over fourteen inches at Hardin. Other precipitation figures for Big Horn County for 1969 were 16.09 inches at Pryor and 19.08 inches at Wyola.

In general, precipitation occurs as steady rains in the spring months of April through June, intermittent showers throughout the summer and early fall months, and as snowfall in the winter months. The majority of the precipitation in the lower valleys and agricultural areas occurs during the growing season. Precipitation in the mountainous areas is fairly steady throughout the year. Much of the precipitation during the winter months occurs as snowfall, and the resulting heavy snowpack produced in the high mountains each year contributes significantly to the water resources. Snow begins to accumulate in November in the higher mountain valleys and continues to build up until late March or early April. Portions of the high mountain snowpack in Big Horn County and in other adjacent drainage areas remain until the warm temperatures of late spring and early summer begin to melt them. The runoff from the snowpack at this time of the year enables irrigation reservoirs to be filled before periods of maximum demand for water in the valleys below.

The use of surface water is widespread for domestic, agricultural, and recreational purposes. The town of Hardin uses surface water from the Big Horn River for its municipal supply. (See Table 7 for a chemical analysis of this water supply.) Agricultural uses of water are very important to the county. The 1964 Census of Agriculture indicates that over 52,000 acres were being irrigated at that time. As is the case in most counties in eastern Montana, the potential exists for the irrigation of even more acreage. A final but important use of surface water is for recreational purposes. The lakes, reservoirs, and streams in the county are ideal habitat for fish and waterfowl and draw many fishermen and hunters to the area each year.

Water Use Classification

The Water Pollution Control Council has classified the streams and drainages in Montana according to the water use classification definitions shown in Appendix I. The streams and drainages of Big Horn

TABLE 7

Chemical Analysis of Municipal Water Supplies
(All Figures in Milligrams per Liter)*

City or Town	Crow Agency	Custer Battle	Hardin	Lodge Grass	Wyola
Source	Well	Well	Big Horn River	Well	Well
Date	11/66	7/64	6/66	5/69	5/69
Total Solids	470	800	800	1240	1170
Hardness	275	311	352	40	600
Ca	77	-	92	4	128
Mg	20	-	30	7	68
Na+K	70	-	124	393	114
CO_3	0	0	0	0	0
HCO_3	300	440	244	445	360
SO_4	160	-	376	494	492
Cl	7	11	20	10	22
NO_3	0.0	0.5	0.0	0	6.0
F	0.5	-	0.5	0.82	0.54
Fe	0.10	0.60	0.8	0.0	0.0
As	-	0.002	-	-	-
Pb	-	0.00	-	-	-
Cu	-	-	-	0.0	0.0
Zn	-	-	-	0.0	0.0

* See Appendix I, Table A, for accepted water quality standard standards

Source: State Department of Health, Helena, Montana

County and surrounding areas are classified as follows:

Yellowstone River drainage from the Billings water supply intake to the North Dakota line except the tributaries listed below:	$B-D_3$
Pryor Creek drainage	$B-D_1$
Big Horn drainage above but excluding William's Coulee to the	$B-D_2$

Yellowstone River except the Little Big Horn listed below:	
Little Big Horn drainage above and including Lodge Grass Creek near Lodge Grass	B-D$_1$
Remainder of the Little Big Horn drainage	B-D$_2$
Tongue River (mainstem) from Tongue River Reservoir to but excluding Prairie Dog Coulee	B-D$_2$
Remainder of the Tongue River drainage	B-D$_3$

Ground-Water Resources

Ground water from wells and springs is used by many residents of Big Horn County. The communities of Crow Agency, Lodge Grass, and Wyola have appropriated ground water from drilled wells for municipal use. (See Table 7 for chemical analyses of these water supplies.) Private wells and springs supply water to many residents of other communities in the county. As of January 1970, 496 well and 279 spring appropriations were on file with the Montana Bureau of Mines and Geology for Big Horn County. A total of eighty five wells are reportedly used for domestic purposes, 226 for livestock, twenty for irrigation, 146 for a combination stock and domestic purpose, and nineteen for various other purposes. There are four springs used for domestic purposes, 214 for livestock, nine for irrigation, and twelve for a combination stock and domestic purpose; uses for forty springs are not reported. There may be numerous wells and springs used in this county that have not been recorded with the state.

There are numerous reports that discuss geological conditions in Big Horn County. The most useful of these is Tom, W. T., Hall, G. M., Wegeman, C. H., and Moulton, G. F., 1935, Geology of Big Horn County and the Crow Indian Reservation: United States Geological Survey Bull. 856. Reports that describe hydrogeological conditions in the county are U. S. G. S. Water Supply Paper 1487, which describes the geology and ground-water resources of the lower Little Big Horn River valley, and U. S. G. S. Water Supply Paper 1876, which describes the geology and ground-water resources of the lower Big Horn Valley.

The occurrence, availability, and quality of ground water in Big Horn County is dependent on geological conditions. The county has had a complex geological history, and as a result, geological conditions in the county are highly variable and complicated. The geological history of the area includes long periods of sedimentation interrupted by periodic uplift and erosion. At the end of the Mesozoic Era (65 million years ago) a period of uplift, folding, and faulting occurred. Sediments in Big Horn County were eroded, and thick layers of rocks were removed. Deposition of erosional debris occurred in ancient stream drainages. Periodic upwarping and erosion created during the Tertiary (one to 65 million years old) and Pleistocene (twenty thousand to one million years old) a number of sedimentary and terrace deposits in the county. The most recent cycle of erosion and deposition has produced broad bottom lands.

Geological formations of importance to the ground-water resources of Big Horn County are the Madison Limestone, Amsden Formation, and Tensleep Sandstone of Paleozoic age (230 to 600 million years old); the Morrison and Cloverly Formations and the Parkman Sandstone and Hell Creek Formation of Mesozoic age (65 to 230 million years old); the Fort Union Formation of Tertiary age, and terrace and alluvial deposits of Quaternary age (less than one million years old).

The oldest water bearing formation of significant interest in Big Horn County is the Madison Limestone. The Madison consists of massive, light colored limestone with numerous solution channels in the upper two hundred feet. The formation is about seven hundred to twelve hundred feet thick and yields moderate to very large quantities of water to wells. This formation outcrops in the Big Horn and Pryor Mountains in the southwestern part of the county. Water from the Madison is usually hard but is suitable for stock, domestic, and irrigation use. In the central, northern, and eastern parts of the county the Madison is too deeply buried to be of interest, and the quality of water is poor.

Overlying the Madison Limestone is about 250 to three hundred feet of orange, gray, red, and brown siltstone and limestone of the Amsden Formation. The Amsden is exposed in the Big Horn and Pryor Mountains. Wells drilled into the Amsden usually have good yields, but water quality becomes poorer away from the outcrop.

Above the Amsden is the Tensleep Sandstone, which consists of about zero to one hundred feet of light colored sandstone. The Tensleep will yield large quantities of water (several hundred gpm) to wells in some areas. Quality of the water is fair. This formation is deeply buried except along the edge of the Big Horn and Pryor Mountains.

Overlying the Tensleep Sandstone are a number of formations that are predominantly shale and will yield little water to wells. The aggregate thickness of these formations is about fifteen hundred feet. The Cloverly Formation overlies these shales. The Cloverly consists of about two hundred to four hundred feet of interbedded sandstone, siltstone, and shale. The sandstone layers yield moderate to large quantities of fair quality water. In some areas yields are poor and quality of the water may be poor due to traces of oil in the water. The Cloverly Formation underlies most of the county and is exposed along the edge of the Pryor and Big Horn Mountains.

Above the Cloverly is another series of formations that are predominantly shale. These formations are a total of about 4,500 feet thick and generally are poor aquifers. The Parkman Sandstone overlies these shale formations. The Parkman is about 250 feet thick and is a good aquifer. Water from the Parkman is usually moderately mineralized and is poor for irrigation. The Parkman consists of massive sandstones and silty shale and is exposed along the Little Big Horn River and in the northern part of the county and underlies the eastern county area.

The Bearpaw Shale, consisting of about six hundred feet of essentially non water bearing shale, is overlain by about six hundred feet of sandy shale and sandstone of the Hell Creek Formation. The Hell Creek will yield small to medium quantities of fair quality water. The Hell Creek is little used as a source of water in the county.

The Fort Union Formation overlies the Hell Creek Formation and is exposed over a broad area in eastern Big Horn County. The lower part of the Fort Union Formation is about one thousand feet thick and yields small to moderate supplies of fair quality water. The upper part of the Fort Union attains a maximum thickness of about eighteen hundred feet and consists of interbedded sandstone, shale, and coal layers. The sandstone and coal beds yield small to moderate quantities of fair quality water to wells.

The Wasatch Formation, consisting of about 350 feet of clay, sandstone, and shale, is present in the southeastern corner of Big Horn County. The Wasatch will yield small quantities of fair to poor quality water.

Along the Big Horn and Little Big Horn Rivers and major tributaries there are terrace and alluvial deposits of Quaternary age. Terrace deposits along the rivers are up to forty feet thick and are as much as six hundred feet above the present streams. The terraces will yield small to moderate amounts (five to one hundred gpm). Flood plain deposits, ranging in thickness from five to forty feet, are present along the rivers. These deposits consist of sand, gravel, silt, and clay. Locally the alluvium will yield as much as one hundred gpm from wells, but the quality of water is poor in some areas. The alluvium is recharged by seepage from nearby streams and from irrigation water.

In summary, a variety of bedrock formations supply ground water to residents of Big Horn County. A wide variety of hydrologic conditions exist, and water yields from wells vary from a few to many thousands of gpm. The bedrock is capable of considerable additional ground-water development. Alluvial deposits yield water to numerous wells and can be further developed. Use of available technical reports will assist in future development of the county's ground-water resources.

Sources:
1. M. K. Botz, Montana Bureau of Mines and Geology, Butte, Montana, 1970
2. State Department of Health, Helena, Montana
3. U. S. G. S. Water Supply Papers and "Surface Water Records of Montana"
4. "Water Resources Survey," Big Horn County, Montana Montana Water Resources Board, Helena, Montana 1947
5. Weather Bureau, Climatological Data, Montana Section, 1969

THE SOILS

General

General descriptions of soils in specific areas are useful in predicting the potential problems which might be encountered during private and public works construction. Big Horn County has an interesting and quite complicated geologic history which has greatly influenced the soil structure of the area. The dominating physiographic features of Big Horn County are portions of the Pryor and Big Horn Mountains on the southwest, and Big Horn and Little Big Horn drainages, and the rolling, upland plains of the north and northeastern portions of the county.

The soils of Big Horn County were derived from parent materials originally located in the valleys and adjacent mountains. The parent materials, which are primarily sedimentary rocks, were eroded, transported, and deposited by various processes, and thus the soils resulting consist of stream deposits or alluvium or the alterations of these materials due to various conditions of climate, topography, and living organisms.

Soil Map

The Soil Conservation Service of the United States Department of Agriculture has prepared a general soil map for Big Horn County. The map as presented by them is shown in this report as Map 4. In developing this map, the Soil Conservation Service made field studies and observations which resulted in the designation of twenty five soil associations. Each association, as a rule, contains a few major soils and several minor soils. Soils within an association may differ greatly in short distances and any one soil may occur in more than one association. Thus, the general soil map does not show the kind of soil at any particular point but shows specific patterns of soils.

The Soil Conservation Service is continuing to expand the detailed soil study of Big Horn County. More detailed information regarding specific areas is available from the Soil Conservation Service office in Hardin, and it is recommended that all available data be utilized during the planning of public works projects. In addition, on site soil investigations for specific projects should be performed.

The Soil Conservation Service preliminary draft descriptions of the twenty five soil associations shown on the general soil map are presented as follows:

1. Pierre-Lismas-Kyle Association. These are clay soils of rolling to steep uplands and valleys.

2. Bainville-Midway Association. These are loam and clay loam soils of hilly to steep uplands.

3. Abac*-Dryhead* Association. These are loam and silt loam soils of rolling to very steep uplands and valleys.

4. Haverson-Glenberg Association. These are loam and fine sandy loam soils of the major stream valleys.

5. Judith-Danvers-Utica Association. These are loam and gravelly clay loam soils of gently sloping to moderately steep gravel terraces.

6. Korchea*-Farnuf*-Savage Association. These are nearly level to gently sloping loam and silty clay loam soils of the large stream valleys.

7. Wibaux-Searing Variant*-Bainville Association. These are loam and channery loam soils of rolling steep and very steep shale and baked shale uplands.

8. Ringling-Searing-Arnegard Association. These are loam and channery loam soils of rolling to very steep shale uplands and valleys.

9. Worland-Creighton* Association. These are sandy loam soils of rolling to very steep shale uplands and valleys.

10. Keiser Association. These are silty clay loam and clay loam soils of gently undulating to moderately steep gravel terraces.

11. Reeder-Delphia-Yawdim Association. These are loam and silty clay loam soils of rolling to hilly shale uplands.

12. Werner*-Vebar-Parshall Association. These are sandy loam soils of undulating to hilly sandstone uplands and valleys.

13. Absarokee-Maginnis Association. These are silty clay and channery loam soils of undulating to very steep hard shale uplands.

14. Absarokee Association. These are clay loam and soils of sloping to hilly mixed hard shale and sandstone uplands.

15. Lap*-Skaggs*-Vairant Association. These are loam and very channery silty clay loam soils of moderately steep to very steep limestone and shale uplands.

16. Shorey-Stormitt*-Garvin* Association. These are loam and very gravelly to bouldery loam soils of sloping to moderately steep valleys, basins, and limestone uplands.

17. Roundup*-Lodgegrass*-Belfield Association. These are clay loam and silty clay loam soils of sloping to steep shale or gravel mantled uplands and valleys.

18. Lap*-Hound*-Bin* Association. These are loam, clay loam and clay soils of moderately steep to very mixed shale and limestone uplands.

19. Yawdin*-Castner*-Roundup* Association. These are clay loam, silty clay loam,and channery loam soils of hilly to steep shale and hard sandstone uplands.

20. Beauvais* Association. These are silty clay loam and silty clay soils of gently undulating to moderately steep gravel terraces.

21. Thebo*-Lisam* Association. These are clay soils of hilly to steep clay shale uplands.

22. Midway-Bainville-Nunn Association. These are silty clay and loam soils of hilly to steep shale uplands and valleys.

23. Yawdim*-Regent-Shale Outcrop Association. These are silty clay loam soils of hilly to very steep shale uplands.

24. Bainville-Travessilla Association. These are loam soils of steep shale and hard sandstone uplands.

25. Midway Association. These are clayey soils of sloping to rolling uplands and valleys.

* Tentative name subject to change in correlation.

Conclusions

The soils of Big Horn County have generally been easy to deal with where shallow domestic water wells and individual sewage drainfields have been constructed. The alluvium and other soil deposits have been found to be extremely variable in permeability, however. This has had an effect on both the quantity of water available in shallow domestic wells and the successful operation of individual sewage drainfields. Some areas of extensive clay and silt deposits require special care in the construction and operation of septic tank drainfields.

Construction of municipal water and sewer systems in the various soils of Big Horn County has not been found to be difficult. Pipeline trench digging in the sands and clays is extremely easy while the coarse alluvium or stream gravels slow operations somewhat. As indicated in the soil descriptions, some bedrock can be expected at normal water and sewer line installation depths at specific isolated locations. Detailed soil information should be obtained before project planning and construction cost estimating are begun.

Source: U. S. Department of Agriculture, Soil Conservation Service, Hardin, Montana

COMMUNITY WATER SYSTEM FACILITIES

General

This comprehensive report covers the overall problems, existing or projected, for Big Horn County, Montana. The volume of data processed and evaluated and the intent of the report allow only a general analysis of any one system.

The intent of this report is to point out the general needs of each community with the objective that each community may in the future be provided with a safe and adequate water system. The general solutions to overall problems suggested in this report may have to be modified when detailed studies are made. These modifications may be in exact size of parts of a system or in some detailed design variation but will not detract from the overall value of the general information presented.

Basically, the demand for water from community systems is for domestic, fire fighting, and industrial uses. The demand for industrial water supply in small communities has not been extensive in Montana and in most cases will not control the design of community systems. Sufficient water for fire fighting must be considered; however, economic feasibility will usually control the extent of such facilities. In most small communities a system with sufficient capacity to give high ratings for fire protection would require facilities considerably larger than necessary for domestic purposes. The community might be unable to finance such an improvement; the approach, therefore, has been to propose a system suitable for present domestic needs. These basic facilities can be expanded for more complete service and for higher fire ratings as it becomes economically feasible.

The domestic use of water has increased greatly in recent years. This is partially due to improved economic conditions which make it possible for families to acquire such water consuming appliances as dishwashers, waste disposal units, and automatic washing machines. Water use for beautifying property has also increased. The most essential condition is adequate, safe, and potable water for domestic purposes, and this has been the primary consideration in this study. See Appendix II for further comments on analysis criteria.

Basic Considerations

Communities studied in this comprehensive plan were those with a minimum of five potential users and a maximum population of 5,500. Each community within this category was visited at least once. During these visits the type of water facilities available was examined, and an evaluation of the facilities was made from the standpoint of fulfilling the needs of the residents.

The existing systems were found to be quite varied in their operation, condition, and suitability for serving the needs of the users. The situation in each community was evaluated separately; however, some general classification of the various systems was possible. These are described briefly in the following paragraphs so that the general philosophy of the analysis can be shown.

1. In some communities the homes are quite widespread and few in number. Good water in adequate quantities can be found at reasonable depths, and for such situations, private wells will provide a safe and suitable water system.

2. Many communities have had access to good water from private wells for many years. In some of these communities population is increasing, and the area is becoming more densely settled. As a result, tests for bacteriological quality of well water occasionally indicate that pollution is present. When this occurs, it is usually the beginning of a problem which will continue to worsen. Increasing population and a higher potential for contamination indicate the need for a safe community water facility. The system should be one which will serve the domestic needs of the present residents with provisions for improvements and expansion as needed.

3. Many communities have enjoyed a central water system for years but have not made annual improvements and replacements. This has resulted in overloaded and antiquated systems. Suggestions for immediate improvements which will fit into an overall replacement program are included in this report.

4. Some communities which have experienced a steady population growth are finding that their water systems are inadequate for present demands and will require enlargement. Population projections and economic trends are used to determine the need for improvements and also to justify the type and extent of proposed improvements.

Big Horn County

The estimated 1970 population of Big Horn County is ten thousand. Approximately 4,960, or fifty percent of these people, are presently served by central water systems, and the remainder are served by such facilities as wells and springs. By 1980 about 5,395, or fifty one percent of the population, will have access to central systems if the schedule of proposed system improvements is followed. It is expected that the remaining forty nine percent will live in outlying areas, and the homes will not be close enough together to make central systems feasible.

Hardin

Existing System. The present population is estimated to be 2,900. Population projections indicate that the town will increase in population throughout the planning period. The town is served by a central water system, and the layout is shown on Map 5.

Water supply is obtained from the Big Horn River just east of town. A twelve inch raw water line carries water from the river to the treatment plant located as shown on Map 5. This water line has sufficient capacity for the present and future needs of the town. A water treatment plant with complete treatment facilities is presently in existence. This facility has a capacity of two million gallons per day (gpd). Some water shortage is experienced during high demand periods, and it will be necessary to increase the treatment plant capacity in the near future. The distribution system consists of six, eight, ten, and twelve inch water mains which provide adequate flows and pressures throughout the community. A 500,000 gallon steel storage tank is located on high ground to the west of town. This facility has sufficient capacity for the present and future needs.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 2,975. The community is expected to grow to the north and west as shown on Map 5. A new supply line carrying water from the treatment plant to the area north of town is proposed. Eventually this feeder line should extend back to the supply line from the storage facility. This will result in a loop of larger diameter water mains which will tend to improve flows and pressures in the newly developed areas of the town.

Additional water supply will also be necessary during this period. It is proposed that an additional one million gpd be developed. It would be possible to expand the present treatment facilities to produce this additional amount of water. An alternate water supply could be obtained from the Two Leggins Canal west of town. This proposal would require a separate plant for the water from this source or a supply line to the existing treatment plant. If this source is developed, the supply line is recommended. A third possibility would be water supply from the contemplated pipeline from Yellowtail Reservoir. This third water source is in the early planning stages and is not expected to become a reality for some time. Either of the other sources would produce an adequate quantity of good quality water for the needs of the town.

Expansion of the distribution system into new areas of development will be necessary during this period. Repair and replacement of the older cast iron water mains will be necessary during this period. A program is presently under way for the replacement of these lines.

Improvements by 1990. For 1990 the population is expected to be 3,300. The existing water system together with the improvements proposed under the five to ten year plan will result in a facility which is adequate for the needs of this population. Expansion of the distribution system into new areas of development will continue to be necessary. Minor repair and replacement will also be required to keep the system in satisfactory operating condition.

Lodge Grass

Existing System. The present population is estimated to be 750. Population projections indicate growth throughout the planning period. The town is served by a central water system, and the layout is shown on Map 6.

Two wells, located as shown on Map 6, presently furnish water supply for the town. The combined capacity of these wells is five hundred gpm which is adequate for the present and future needs. Storage presently consists of a 110,000 gallon elevated storage tank, and this facility has adequate capacity for the present and future needs. The distribution system consists of four, six, and ten inch water mains which provide adequate flows and pressures throughout the community. The distribution piping consists of steel pipe which has deteriorated because of an electrolysis problem. A replacement program is presently being conducted on an as needed basis and will continue until all the older lines are replaced.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 775. An existing well with a very high well yield is presently in existence in the community. The community is planning to tie this well into their present water system for an additional water supply. When this is done the result will be a very adequate quantity of water being available for the users. The distribution system and storage facilities will be adequate for the needs throughout the planning period. Repair and replacement of the older steel lines will be necessary as previously mentioned. Extension of the distribution system into new areas of development will also be necessary as shown on Map 6.

Improvements by 1990. For 1990 the population is expected to be 825. The existing water system together with the improvements proposed under the five to ten year plan will provide a facility which is adequate for the needs throughout the entire planning period. Repair and replacement will be necessary to keep the system in satisfactory operating condition.

Crow Agency

Existing System. The 1970 population is estimated to be 750. Population projections indicate that the town will show substantial increase throughout the planning period. The town is served by a central water system, and the layout is shown on Map 7.

Water supply is obtained from the Little Big Horn River located south of the town. A complete water treatment plant with a capacity of 0.72 million gpd is located at the river. This treatment plant produces an adequate quantity of good quality water for the present needs of the community, but it is anticipated that the plant will have to be enlarged during the planning period. An eight inch supply line continues on to the distribution system. This supply line has adequate capacity. The distribution system consists of four, six, and eight inch water mains which provide adequate flows and pressures throughout the community. A storage facility with a capacity of 750,000 gallons is located on high ground to the west of town. This is an adequate amount of storage for the present and future needs of the community.

Improvements Next Five to Ten Years. For 1975 the population is expected to be eight hundred. The existing water system will adequately serve the needs of this population. It is not anticipated that major expansion of the system will be necessary during this period. There is a rug factory presently located in the community which uses large quantities of water. Should this industrial operation expand or if additional industry is developed in the area, it will be necessary to increase the output of the water treatment plant. As previously mentioned, it is not expected that this enlargement will be necessary during this period.

Improvements by 1990. For 1990 the population is expected to be eleven hundred. Some expansion of the distribution system into new areas of development will be necessary to provide service to this additional population. Enlargement of the water treatment plant will also be necessary. To serve the needs of the 1990 population, it will be necessary to increase the output of the treatment plant to one million gpd. The possibility of additional industrial development may necessitate enlargement of the treatment plant beyond the proposed one million gpd; however, the amount of this increase would have to be determined through detailed studies prior to the actual enlargement.

Expansion of the distribution system to provide service to new areas of development will continue to be necessary during this period. Minor repair and replacement will be required to keep the system in satisfactory operating condition.

Busby

Existing System. The 1970 population is estimated to be 350. Population projections indicate that the town will increase in population throughout the planning period. The town is presently served by a central water system, and the layout is shown on Map 8.

Water supply is obtained from three wells with a combined capacity of 220 gallons per minute (gpm). As a result, there is an adequate quantity of water available for the present needs. Storage is provided by two elevated tanks with a combined capacity of 115,000 gallons, an adequate amount of water storage for the present and future needs of the community. The distribution system consists of four, six, and eight inch water mains which provide adequate flows and pressures throughout the system. The water system is reportedly in satisfactory operating condition and does provide adequate service to each user.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 375. During this period it is proposed that water service be extended to all areas of the community where development presently exists. The existing water system has sufficient capacity for this expansion. Minor repair and replacement will be required to keep the system in satisfactory operating condition.

Improvements by 1990. For 1990 the population will be five hundred. During this period it is proposed that an additional well with the capacity of eighty gpm be developed. This will produce an adequate quantity of water for the additional demand created by increased population. Minor repair and replacement will continue to be necessary throughout the distribution system. Some expansion of the distribution system into new areas of development will also be required.

St. Xavier

Existing System. The sixty persons who presently reside in this community obtain their water supply from private wells. The quality of the water is reportedly good; however, it is classified as hard. An adequate quantity of water is available for each household. The wells range in depth from twenty five to thirty feet. These private wells do provide an adequate water supply for the population of this community.

Improvements by 1990. For 1990 the population is expected to decline to thirty. Throughout the entire planning period the present use of private wells will continue to be the most suitable means for obtaining water supply. The development in the community is spread over a rather large area resulting in high initial cost for the installation of any central piping network.

Wyola

Existing System. The present population is estimated to be 130, and population projections indicate that the town will decrease in population throughout the planning period. The town is presently served by a central water system, and the layout is shown on Map 10.

Water supply is obtained from a dug well with a capacity of fifty gpm. This water supply is adequate during most periods of the year; however, shortage is experienced during the hot summer months. When the water level in the stream lowers, the quantity of water available to the dug well decreases thereby creating the water shortage. The distribution system consists of two, three, and four inch water mains which provide adequate flows and pressures throughout the community. A storage facility is located to the east of town and has a capacity of 33,000 gallons. This storage facility is adequate for the needs throughout the entire planning period.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 110. During this period it is proposed that a new well be drilled in the location shown on Map 10. A capacity of seventy five gpm will be necessary to adequately supply the system. It is intended that the older dug well be abandoned because of its unreliability, which is caused by the fluctuating level in the stream. Minor repair and replacement will be necessary on the distribution system.

Improvements by 1990. For 1990 the population is expected to be seventy five. The existing water system together with the improvements proposed under the five to ten year plan will result in a facility which is adequate for the needs throughout the entire planning period. Minor repair and replacement will be the only improvements necessary to keep the system in satisfactory operating condition.

Pryor

Existing System. The estimated 1970 population is one hundred. Population projections indicate that the town will increase in population throughout the planning period. The residents presently obtain their water supply from wells. These wells range in depth from twenty to fifty feet and produce an adequate quantity of good quality water. A community water system is feasible for the present population, and the projected increase in population makes the improvement necessary.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 110. During this period it is proposed that a community water system be developed as shown on Map 11. A well with a capacity of eighty five gpm can be developed in the area. Storage facilities with a capacity of thirty thousand gallons are proposed. This system will be adequate for needs throughout the entire planning period.

Improvements by 1990. For 1990 the population is expected to be 150. The system as proposed under the five to ten year plan will provide adequate water service for the needs throughout the entire planning period. Only minor repair and replacement will be necessary to keep the system operating satisfactorily.

Fort Smith

Existing System. The present population is estimated to be eighty, and population projections indicate that the community will decrease in population throughout the planning period. A community water system facility is presently in existence and provides service to the major portion of the town. A well with a capacity of forty gpm provides an adequate supply of water for the system. A storage tank with a 100,000 gallon capacity is in existence and is adequate for the present and future needs of the town. A distribution system consisting of two and four inch diameter water mains provides water service throughout a substantial part of the community. This entire system was developed for a trailer court which was in existence during the construction of Yellowtail Dam. Most of the trailer homes have been removed from the site, and the water system is very adequate for the remaining users.

Improvements by 1990. For 1990 the population is expected to be fifteen. The existing water system will be more than adequate for the needs of the community throughout the entire planning period. Only minor repair and replacement will be necessary to keep the system operating satisfactorily.

Decker

Existing System. The twenty persons who presently reside in this community obtain their water supply from private wells. The wells range in depth from 150 to two hundred feet and produce an adequate quantity of good quality water. The water does have some taste and odor associated with it but local residents do not complain. These private systems do provide an adequate water supply for each household household.

Improvements by 1990. For 1990 the population is expected to decrease to five. The present use of private wells will continue to be a suitable means for obtaining water supply in this community.

COMMUNITY SEWER SYSTEM FACILITIES

General

Each use of water adds some material or alters some characteristic enough to change the original quality of the water and often to pollute it. The transportation and dilution of municipal, industrial, and agricultural wastes are important and necessary uses of water; therefore, special emphasis is placed on the control of water pollution from these sources. Some of these wastes can be carried in limited amounts without damage to the resource. Some wastes if discharged into water courses can make their way into underground aquifers and pollute the ground water so that it is unsuitable for further use.

Pollution by definition and interpretation is a matter of degree. Since it is inevitable that the quality of water will be altered with each use, it is of critical importance to control the degree of pollution.

It is public policy established by the state legislature to maintain reasonable standards of purity for the water of the state. These standards are to be consistent with the use of these waters, including their use in carrying away the water borne waste products of society. The current Federal Water Pollution Control Act in reference to pollution abatement gives the individual states discretion in assessing the physical and economic feasibility of complying with water quality standards. The "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" of the Montana Water Pollution Control Council for streams and rivers in Montana have been included in Appendix I.

Sewage may be broadly categorized as domestic or municipal waste, industrial waste, and animal or agricultural waste. Animal wastes are usually not involved in community sewage facilities; however, they do constitute a potential source of pollution which must be controlled and prevented from entering streams or other potential water supplies.

Although industrial activity throughout Montana has been limited, the need for control and treatment of industrial wastes is apparent. Industrial wastes vary in quantity and composition as greatly as the products and processes which generate them. They include toxic chemicals, solids carried in suspension, brines, strong acids and alkalies, oils, dyes, floating solids, and the heat generated by industrial processes. Industrial wastes are not found to be a major factor in the design of most community sewage facilities. Where economic projections indicate industrial development, the relationship to loading on domestic sewer systems is considered.

Domestic sewage is the primary consideration of this study and have been the basis for design and analysis. Where particular systems are subjected to loading from industrial sources, a more detailed study will be necessary. The general approaches outlined in "Analysis Criteria" in Appendix III will suffice in practically all cases.

Basic Considerations

There are generally three main methods of sewage disposal. There are septic tanks, mechanical sewage treatment plants, and wastewater stabilization ponds. Local soil conditions, availability of land, and density of population are the basic factors which govern the selection of a particular method.

Many of the smaller communities have relied on individual septic tanks and cesspools for each home to handle sewage disposal. Septic tanks are suitable if the population density is low and if the systems are properly designed and maintained. Overflow from these tanks must drain into the soil and, depending on local soil conditions, may or may not create a problem. There is a limit to the amount of water that even loose granular soil can absorb. Density of population and the length of time the effluent has been entering the soil are factors which indicate whether septic tanks can be suitable for sewage disposal.

When economically feasible, community sewage collection and disposal systems are much more desirable than individual systems. Community systems eliminate the worry of septic tank failure, the danger of well contamination, and the problem of soil saturation. However, it is usually uneconomical to serve a few homes scattered over a large area with a community sewer system.

The type of sewage disposal facilities to be used can generally be determined on the basis of economic factors. Mechanical treatment plants provide an excellent means of sewage disposal although the initial cost, maintenance cost, and power cost are usually high. Wastewater stabilization ponds are an ideal method of sewage disposal and usually are the most economical to construct and maintain.

The Montana Water Pollution Control Council has established the criteria that treatment of domestic and industrial wastes shall be secondary treatment or its equivalent. For domestic sewage, mechanical treatment plants or stabilization ponds, when either is properly designed, constructed, and operated, meet these requirements.

A schedule for completion of secondary treatment facilities by communities across the state has been established by the State Department of Health. The target date is included for individual towns when applicable.

Big Horn County

Appriximately 4,830, or forty eight percent of the Big Horn County population, are presently served by community sewer facilities. By 1990 about 5,950, or fifty two percent of the population, will have access to community facilities if the proposed expansion program is followed. The remaining forty eight percent will live in outlying areas, and the homes will not be close enough together to make community systems feasible.

Hardin

Existing System. The present population is estimated to be 2,900. A community sewer system is in existence, and the system layout is shown on Map 14.

A collection system consisting of eight, nine, ten, twelve, and fifteen inch sewer mains picks up sewage from the entire town and carries it to a collection point near the east edge. At this point a lift station picks up the sewage and discharges it into a twelve inch outfall line which continues on to the treatment facilities. Sewage treatment presently consists of a twenty five acre wastewater stabilization pond.

The collection system has adequate capacity for the present and anticipated future flows of sewage. Some of the collection system, such as the nine inch line, is old and has deteriorated to the point where replacement will be necessary. The twelve inch outfall line is operating at near capacity, and enlargement will be required. The wastewater stabilization pond is presently undersized and will have to be expanded in the near future. Plans have been developed for an addition to the treatment facility.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 2,975. During this period it is proposed that a replacement program be started whereby the nine inch lines in the main part of town will be replaced. Extension of the collection system into new areas of development will also be necessary. A lift station will be required at the north edge of town to pick up sewage from that area. An additional twelve inch outfall line will be necessary to carry sewage to the treatment facilities. The need for this improvement will be dependent on the actual increase in population which takes place during the planning period. A fourteen acre addition to the wastewater stabilization pond is proposed for construction during this period. Plans have been developed whereby the construction will be completed in the near future. This will result in a total capacity of thirty nine acres which is adequate for the needs throughout the entire planning period. Minor repair and replacement throughout the collection system will be necessary to keep the system operating satisfactorily.

Improvements by 1990. For 1990 the population is expected to be 3,300. The existing system together with improvements proposed under the five to ten year plan will result in a facility which is adequate for the needs throughout the entire planning period. Expansion of the collection system into new areas of development will be necessary; however, the system will have sufficient capacity for this expansion. Minor repair and replacement will be necessary to keep this system operating satisfactorily through 1990.

Lodge Grass

Existing System. The present population is estimated to be 750. A community sewer system is in existence, and the system layout is shown on Map 15.

A collection system consisting of six, eight, ten, and twelve inch sewer mains picks up sewage from throughout the community and carries it to a collection point near the north edge of town. This collection system is reportedly in good condition, and the lines have adequate capacity for present sewage flows. From the collection point a twelve inch outfall line continues on to the treatment facilities. This outfall line has adequate capacity for the anticipated population of this community. Sewage treatment is presently handled by a six acre wastewater stabilization pond. This facility is presently slightly undersized and will have to be enlarged during the planning period.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 775. The collection system and outfall line will have adequate capacity for the needs during this period. A 2.5 acre addition to the wastewater stabilization pond will be necessary to provide adequate sewage treatment. Minor repair and replacement will be required to keep the system operating satisfactorily.

Improvements by 1990. For 1990 the population is expected to be 825. The existing system together with the improvements proposed under the five to ten year plan will result in a facility which is adequate for the needs of the 1990 population. Minor repair and replacement will be required to keep the system operating satisfactorily. Expansion of the colllection system into new areas of development will also be required; however, the system has adequate capacity for this expansion.

Crow Agency

Existing System. The 1970 population is estimated to be 750. A community sewer system is in existence, and the system layout is shown on Map 16.

A collection system consisting of six, eight, ten, and twelve inch sewer mains picks up sewage from throughout the community and carries it to a collection point near the northeast edge of town. This collection system has adequate capacity for the present and future populations of the community. At the collection point two lift stations are in existence to pick up the sewage and discharge it into the treatment facility. Sewage treatment presently consists of a ten acre wastewater stabilization pond. This treatment facility has adequate capacity for the domestic sewage flows from the community; however, it is presently being overloaded by wastewater from the rug factory which is in existence at the present time. It will be necessary to improve the treatment facilities during the planning period.

Improvements Next Five to Ten Years. For 1975 the population is expected to be eight hundred. During this period expansion of the collection system into new areas of development will be necessary. Also, additional treatment facilities will be required. A study is presently being conducted to determine the type of treatment which would be suitable for the waste from this community. A mechanical treatment plant is one consideration; however, it has not been decided if this treatment facility would be used for the entire community or for just the waste from the rug factory. Under present conditions additional treatment capacity will be required during the next five to ten years. The findings of the special study presently being conducted should be followed for the development of this additional capacity.

Improvements by 1990. For 1990 the population is expected to be eleven hundred. Expansion of the collection system into new areas of development will be necessary. Minor repair and replacement will be required to keep the system in satisfactory operating condition. It is expected that additional treatment facilities will be constructed by this time.

Busby

Existing System. The present population has been estimated to be 350. A community sewer system is in existence, and the system layout is shown on Map 17.

A collection system consisting of six and eight inch sewer lines picks up sewage from throughout the community and carries it to a collection point near the northwest edge of town. At this point an eight inch outfall line then continues on to the treatment facilities. The collection system and outfall line have sufficient capacity for the present and future needs of the community. The piping is reportedly in satisfactory condition, and only minor repair and replacement are necessary to keep the system functioning satisfactorily. Sewage treatment is presently handled by a 3.2 acre wastewater stabilization pond. This facility is adequate at the present time; however, enlargement will be necessary during the planning period.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 375. The existing collection system will be adequate for the needs of this population. Expansion of the collection system into new areas of development will be necessary, and the system has adequate capacity for this expansion. Minor repair and replacement will be necessary to keep this system functioning satisfactorily.

Improvements by 1990. By 1990 the population is expected to be five hundred. During this period it is proposed that a two acre addition be constructed at the treatment facility. This will result in adequate treatment facilities being available throughout the entire planning period. Expansion of the collection system will continue to be necessary during this period.

St. Xavier

Existing System. The sixty persons which presently reside in this community rely on private septic tanks and cesspools for sewage disposal. The soil in the area is a clay material underlain by sand. Properly constructed drainfields operate satisfactorily, and these private systems result in an adequate sewage treatment facilities being available for each household.

Improvements by 1990. For 1990 the population is expected to decline to thirty. The present use of private septic tanks will be the most suitable means for handling sewage disposal throughout the entire planning period.

Wyola

Existing System. The 130 persons who presently reside in this community rely on private septic tanks and cesspools for sewage disposal. The soil in the area is a sandy loam material with good drainage characteristics, and private systems do operate satisfactorily when properly installed.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 110. A community sewer system facility is feasible for this population, and it is proposed that it be constructed during this period. A 1.5 acre wastewater stabilization pond will be adequate for the needs throughout the entire planning period. An eight inch collection system is proposed for the town. A lift station and four inch force main will be required to force the sewage on to the treatment facilities.

Improvements by 1990. For 1990 the population is expected to be seventy five. A portion of this population decrease can be attributed to the present lack of central sanitary facilities. The system as proposed under the five to ten year plan will be adequate for the needs of the community throughout the entire planning period.

Pryor

Existing System. The one hundred persons who presently reside in this community rely on private septic tanks and cesspools for sewage disposal. The soil in the area is primarily a clay material; however, good drainage characteristics are present. These systems do result in adequate sewage disposal when properly installed. The population of the community is expected to increase appreciably throughout the planning period. A community sewer system is feasible for the present population and will be a necessity during the planning period.

Improvements Next Five to Ten Years. The 1975 the population is expected to be 110. It is proposed that a community sewer system facility be developed during this period. A layout of the proposed system is shown on Map 19. A collection system consisting of eight inch sewer mains will be necessary to pick up sewage from throughout the community. A four inch force main and lift station will be necessary to force the sewage on to the treatment facilities. A 1.5 acre wastewater stabilization pond will provide adequate sewage treatment for the community throughout the entire planning period.

Improvements by 1990. For 1990 the population is expected to be 150. The system as proposed under the five to ten year plan will be adequate for the needs throughout the entire planning period. Only minor repair and replacement will be required to keep the system operating satisfactorily.

Fort Smith

Existing System. The eighty persons who presently reside in this community have access to a community sewer system facility. A layout of the system is shown on Map 20.

A collection system consisting of four, six, and eight inch sewer mains picks up sewage from throughout the area and carries it to a collection point near the north edge of town. At the ends of each line septic tanks are located to provide sewage treatment. The overflow from these septic tanks is collected and distributed to drain fields located north of the community. This sewage system is adequate for the present and future needs of this community.

Improvements by 1990. For 1990 the population is expected to decline to fifteen, and the existing sewer system facility will be adequate for the needs throughout the entire planning period. Minor repair and replacement are the only improvements which will be necessary to keep the system operating satisfactorily.

Decker

Existing System. The twenty persons who presently reside in this community rely on private septic tanks and cesspools for sewage disposal. The soil in the area is a clay loam material with good drainage characteristics. These systems reportedly operate satisfactorily and do provide adequate sewage treatment for each household.

Improvements by 1990. For 1990 the population is expected to be five. Throughout the entire planning period the present use of private septic tanks will continue to be the most suitable means for handling sewage disposal.

PREFACE TO MAPS

The following maps have been prepared from several sources. The county maps were prepared from Transverse Mercator Projection Series Maps and Montana Highway Department Maps, Planning and Survey Series. The reduction of the county maps necessary for this publication makes them useful for general reference purposes only.

The town and community base maps used herein are taken from Montana State Highway Commission City and Town Plats prepared from aerial photographs dated 1961 to 1969 and have been updated where necessary. On-site surveys, plats obtained from individual towns, and aerial photography conducted in 1970 were also used. Uncontrolled mosaics have been used and scales are, accordingly, only approximate and are shown for referencing purposes only. The mapping operation was supplemented by field checks made during 1970.

Land use information was obtained by field surveys, supplemented and checked bv aerial photography during 1969 and 1970.

Water and sewer systems maps show existing facilities for individual towns and communities except where the information was not available. Data concerning these community facilities was obtained from the records of the individual communities and of the State Department of Health. Water and sewer lines are shown in the center of streets to indicate the existence of lines rather than precise locations. The sizes of lines, obtained from the most current information available, are indicated when possible. The locations of recommended improvements are given as relative locations and are not meant to be scaled from the individual town or community maps.

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MAP I

COUNTY MAP
GENERAL RELIEF

LEGEND

●	CITIES-TOWNS
○	COUNTY SEAT
——	ROADS-HIGHWAYS STATE HIGHWAY U. S. HIGHWAY
– – – – -	RAILROADS
🟦~	STREAMS-LAKES
—·—·—·	COUNTY BOUNDARY
⋯	INDIAN RESERVATION
☐	0-3,000 FT. ELEVATION
░	3-5,000 FT. ELEVATION
▒	5-7,000 FT. ELEVATION
▓	OVER 7,000 FT. ELEVATION

MAP 2

LEGEND

MAJOR STATE-WIDE COVERAGE

POWER AND GAS SYSTEMS

☐ POWER PLANT (IN MEGAWATTS)

– – – – 1 to 50 KILOVOLTS

——— 51 to 100 KILOVOLTS

–··–·– 101+ KILOVOLTS

········· PROPOSED LINES

–•–•– GAS LINES

RECREATION AREAS

1. LOST CREEK STATE PARK
2. LEWIS AND CLARK CAVERNS STATE PARK
3. LAKE MARY RONAN STATE PARK
4. MEDICINE ROCKS STATE PARK
5. ROSEBUD STATE PARK
6. ROCK CREEK STATE PARK
7. MAKOSHIKA STATE PARK
8. WEST SHORE STATE PARK
9. WOODS BAY STATE PARK
10. BITTERROOT LAKE STATE PARK
11. ASHLEY LAKE STATE PARK
12. LONE PINE STATE PARK
13. JAMES KIPP STATE PARK
14. HOOPER MEMORIAL STATE PARK
15. HELL CREEK STATE PARK
16. FINLEY POINT STATE PARK
17. ELMO STATE PARK
18. FLATHEAD LAKE STATE PARK
19. YELLOW BAY STATE PARK
20. WALSTAD MEMORIAL PARK
21. THOMPSON FALLS STATE PARK
22. WHITEFISH LAKE STATE PARK
23. WAYFARERS RECREATION AREA
24. TIBER RESERVOIR RECREATION AREA
25. CLARK CANYON RESERVOIR RECREATION AREA
26. ENNIS RECREATION AREA
27. DEADMAN'S BASIN RESERVOIR RECREATION AREA
28. PAINTED ROCKS RESERVOIR RECREATION AREA
29. CANYON FERRY RECREATION AREA
30. LOGAN PARK RECREATION AREA
31. NELSON RESERVOIR RECREATION AREA
32. BEAVERTAIL HILL RECREATION AREA
33. GLACIER NATIONAL PARK
34. YELLOWSTONE NATIONAL PARK

▨ NATIONAL FORESTS

MAP 3

COUNTY MAP
LAND OWNERSHIP

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

——— ROADS-HIGHWAYS
STATE HIGHWAY U. S. HIGHWAY

— — — RAILROADS

〰 STREAMS-LAKES

—·—·— COUNTY BOUNDARY

▨ INDIAN RESERVATION

▭ PRIVATELY OWNED LAND

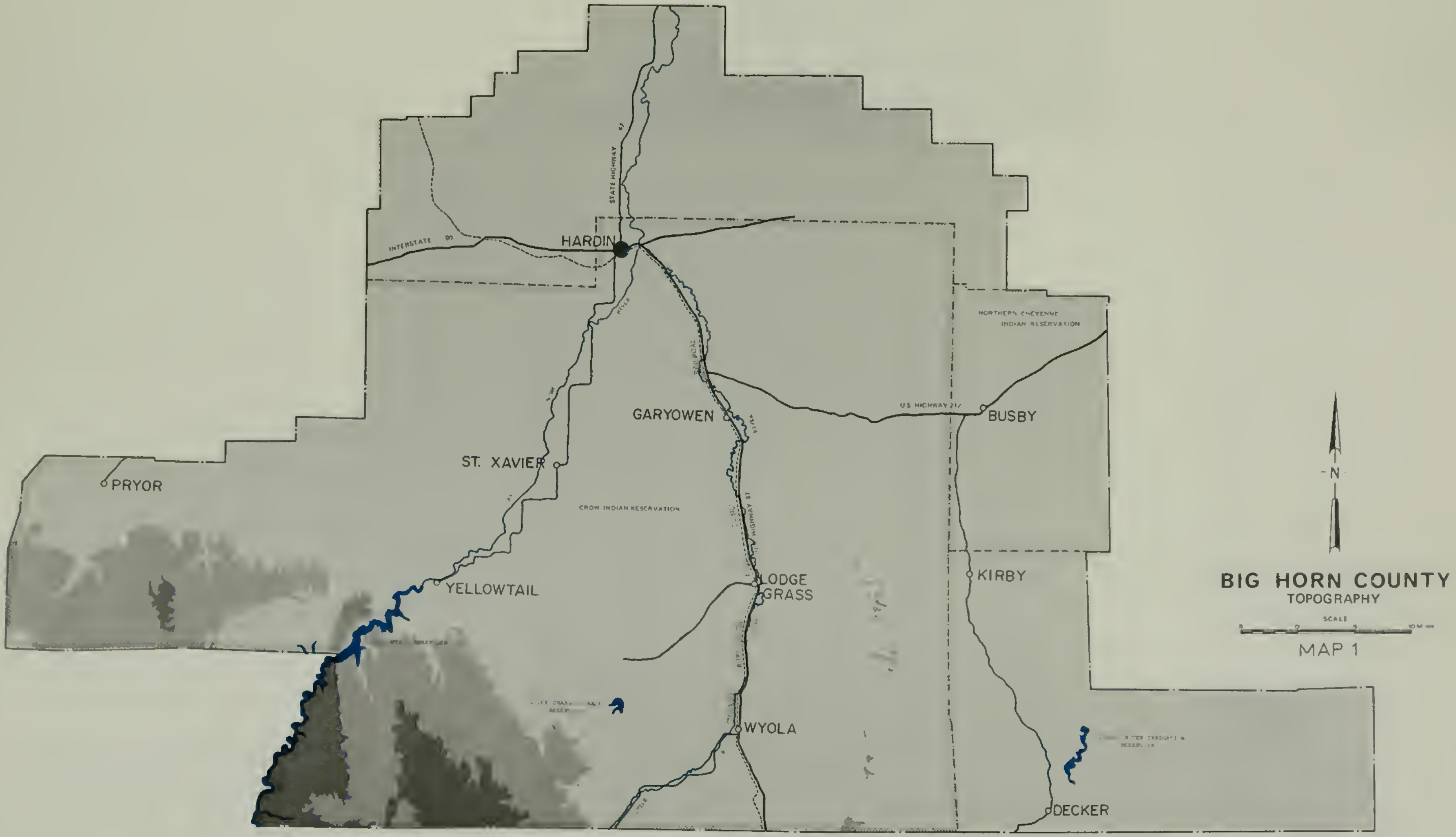
▬ STATE OWNED LAND

▭ FEDERAL OWNED LAND

CITIES MAP LEGEND

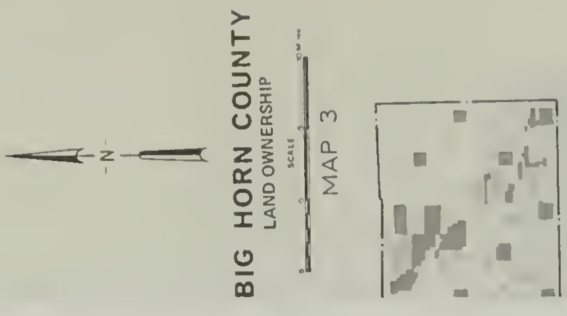
	LAND USE
●	SINGLE RESIDENCE
◗	DILAPIDATED RESIDENCE
Ⓣ	SINGLE TRAILER RESIDENCE
⊕	MULTIPLE RESIDENCE
○	APARTMENTS
⊤	TRAILER COURT
■	COMMERCIAL BUILDING
◪	HOTEL-MOTEL
△	PUBLIC BUILDING
⬡ S	SCHOOL
⬢	CHURCH
⊞	HOSPITAL
✸	INDUSTRIAL
🅴	GRAIN ELEVATOR

	WATER and SEWER SYSTEMS
—6—	EXISTING LINES AND SIZES
- - - -	PROPOSED LINES 5-10 YEAR
┈┈┈┈	PROPOSED LINES 10-20 YEAR
—◀—	EXISTING LIFT STATION
- -◁- -	PROPOSED LIFT STATION
⬤	EXISTING WATER STORAGE TANK
¤	PROPOSED WATER STORAGE TANK
—▣	EXISTING WATER SOURCE
- -▣	PROPOSED WATER SOURCE
—☐	EXISTING TREATMENT FACILITIES
- -☐	PROPOSED TREATMENT FACILITIES
▭	SERVICE AREA 1970-1980
▬	SERVICE AREA BY 1990



BIG HORN COUNTY
TOPOGRAPHY

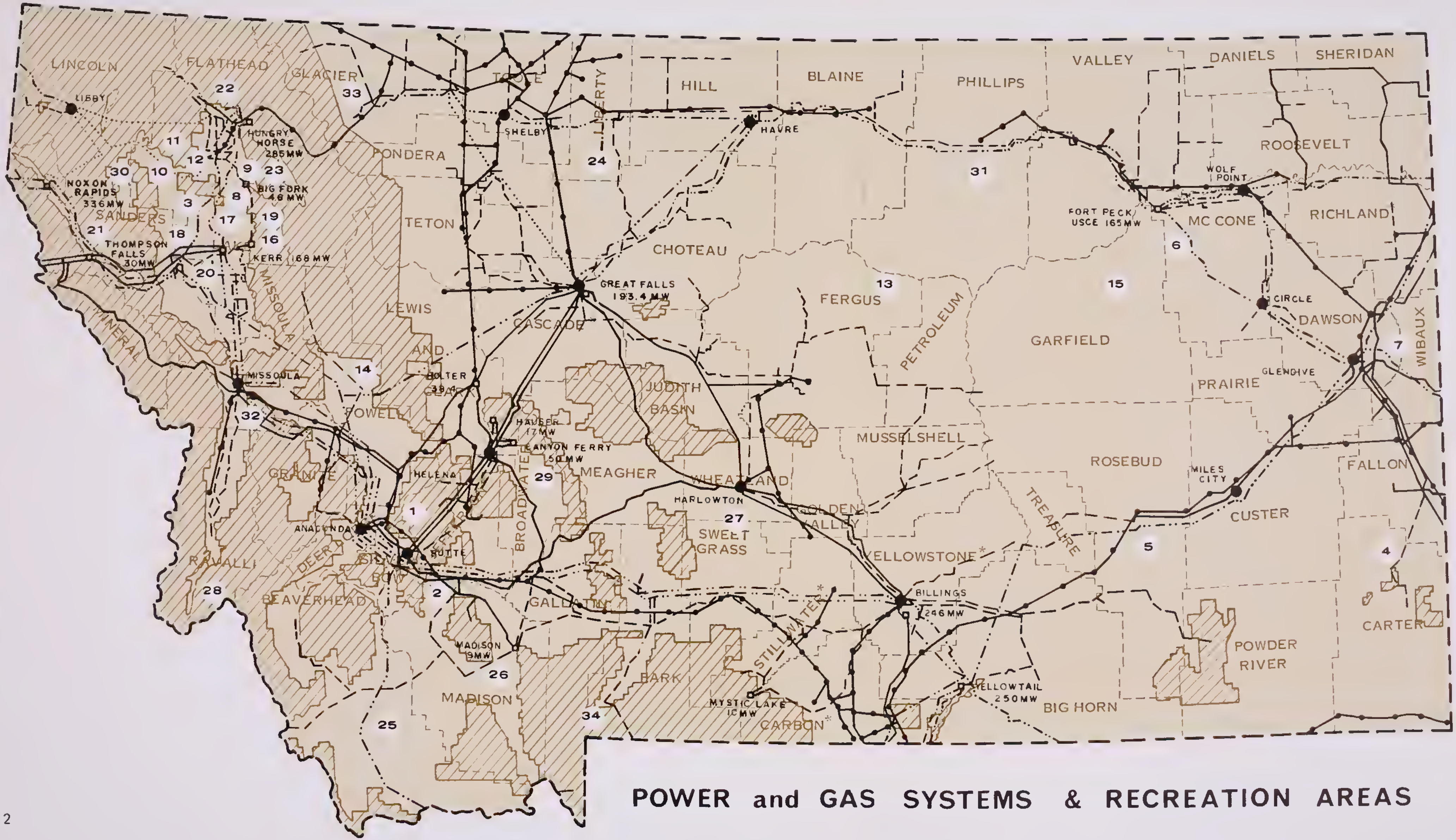
MAP 1



BIG HORN COUNTY
LAND OWNERSHIP

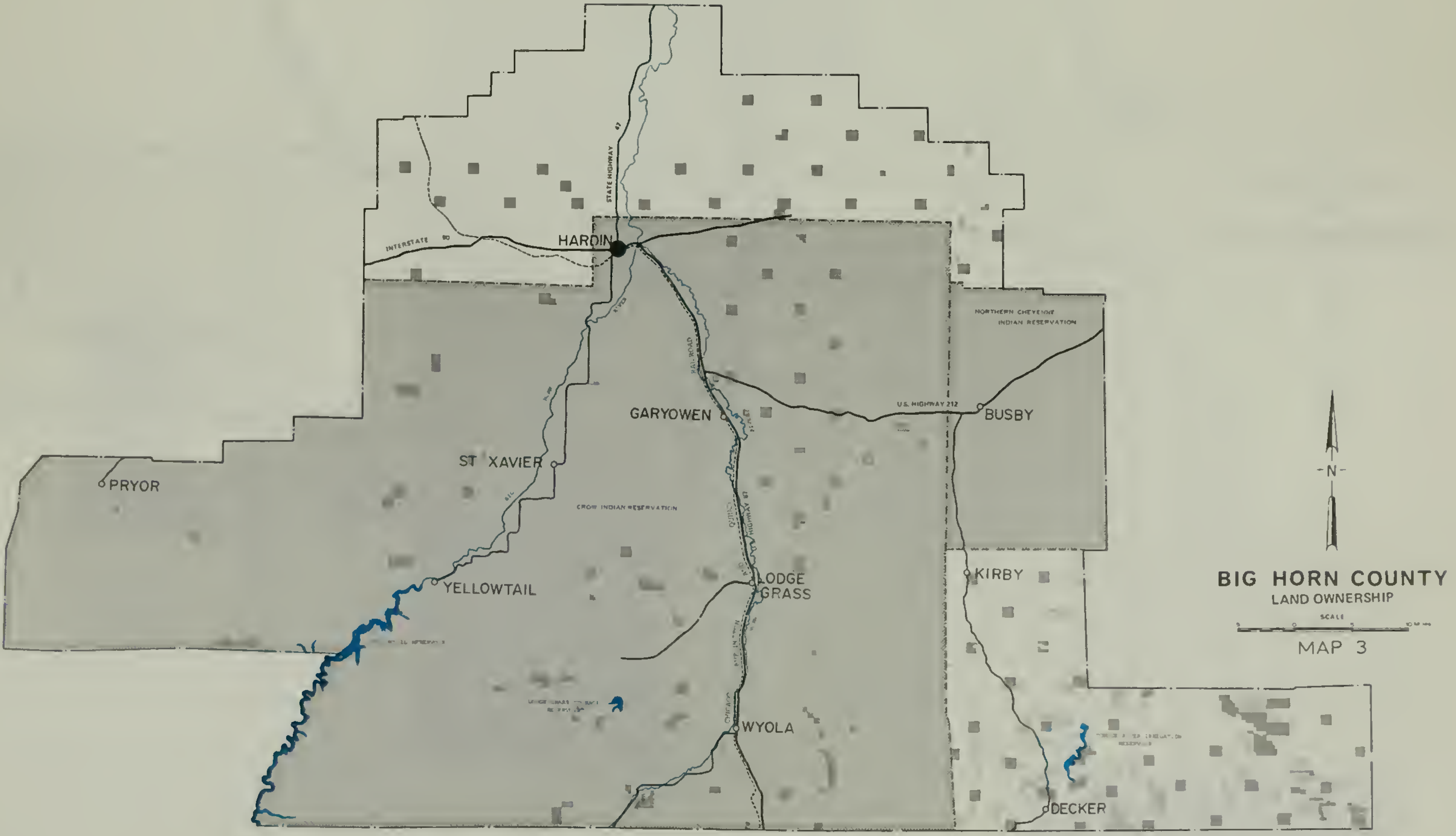
MAP 3

MAP 2



POWER and GAS SYSTEMS & RECREATION AREAS

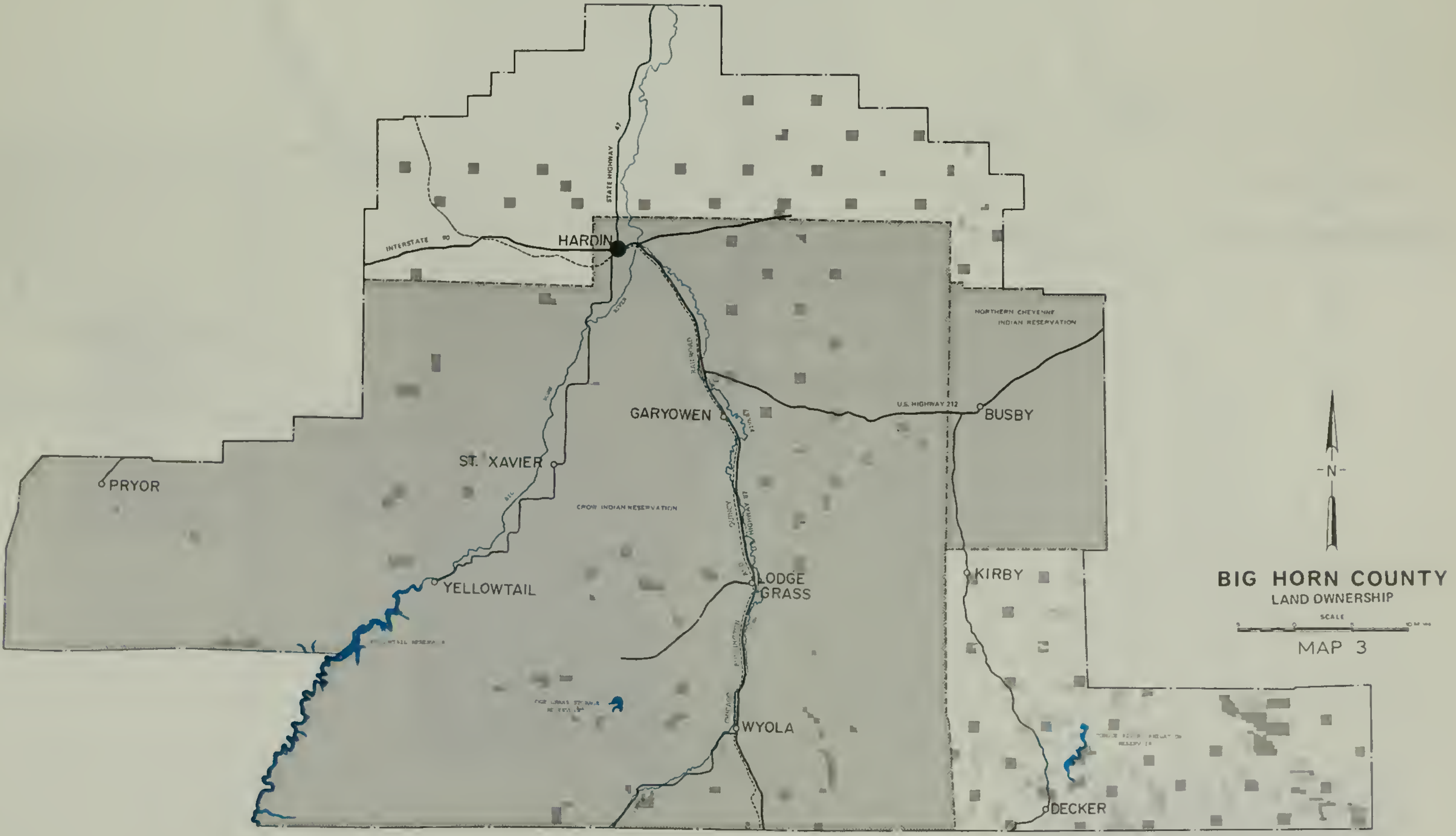
MAP 2



BIG HORN COUNTY

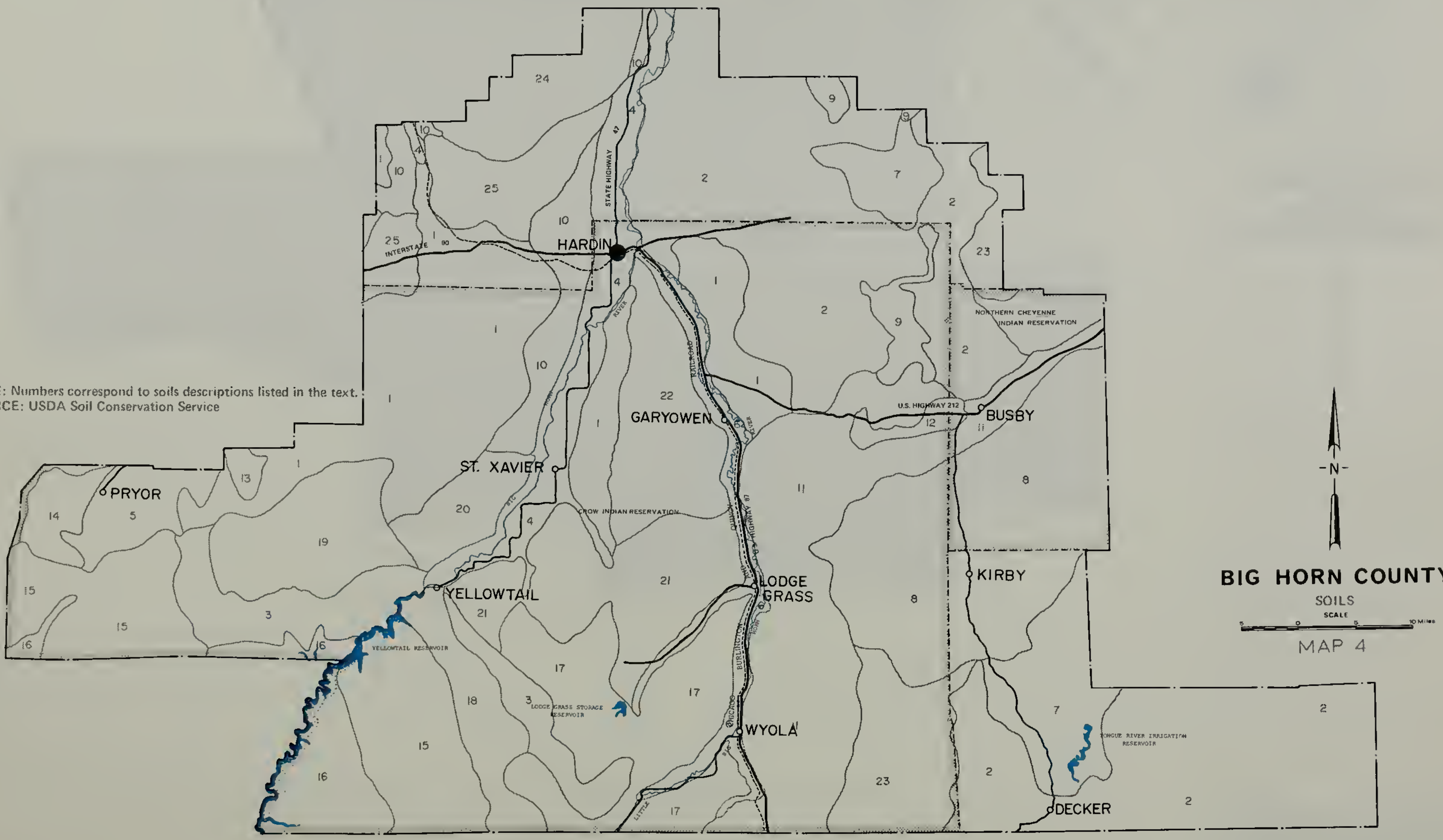
LAND OWNERSHIP

MAP 3



BIG HORN COUNTY
LAND OWNERSHIP

MAP 3

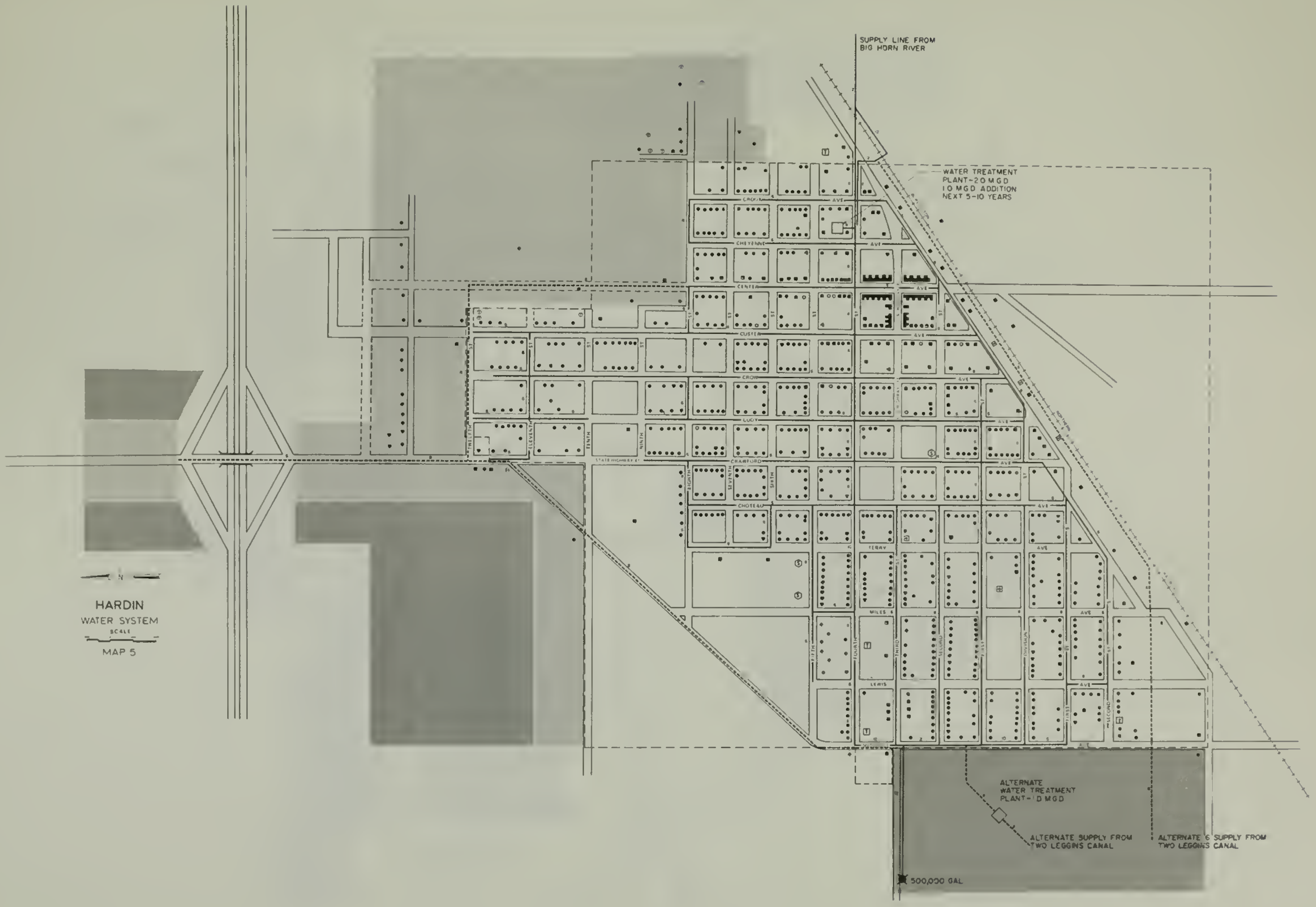


BIG HORN COUNTY

SOILS

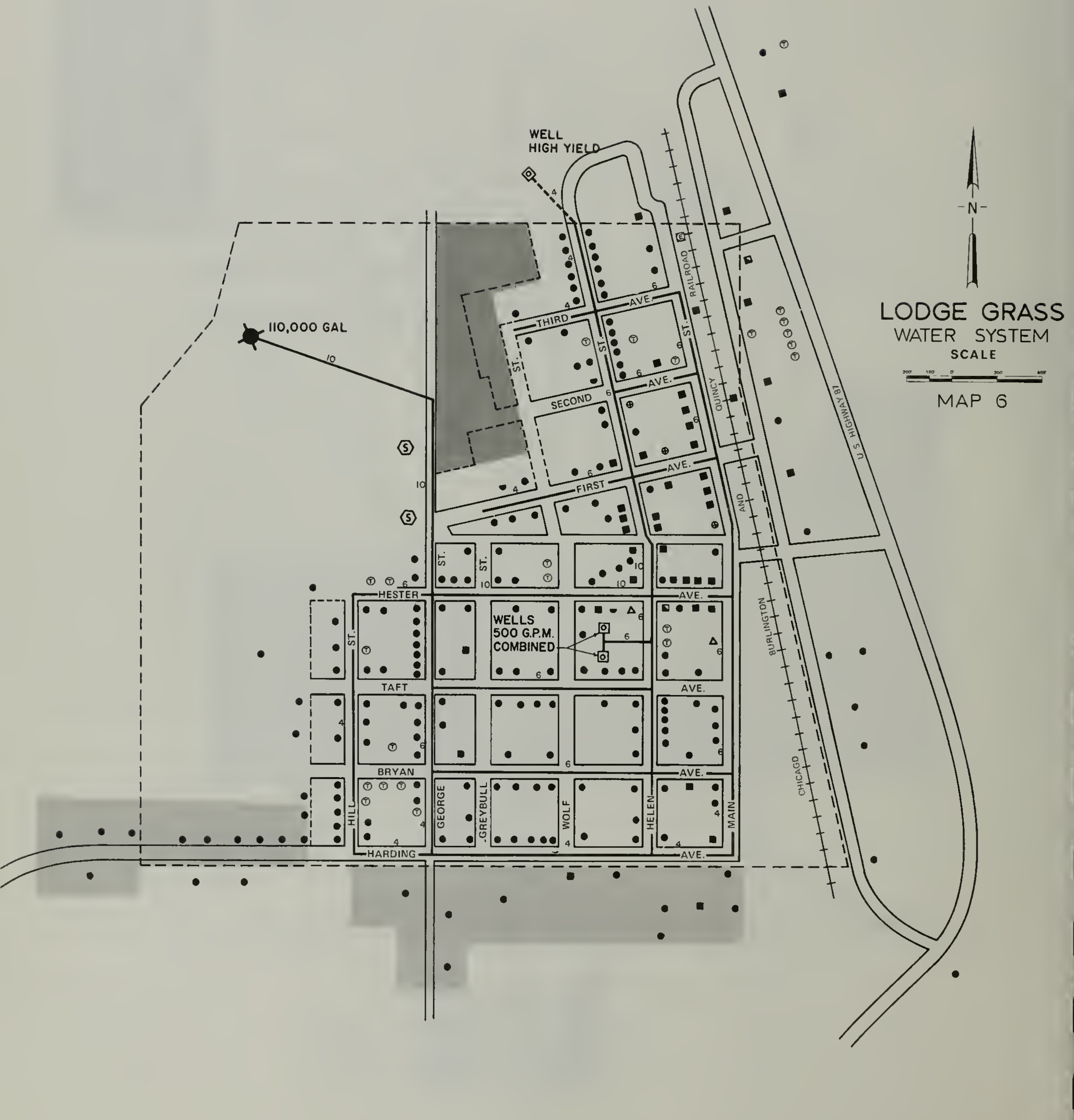
MAP 4

NOTE: Numbers correspond to soils descriptions listed in the text.
SOURCE: USDA Soil Conservation Service



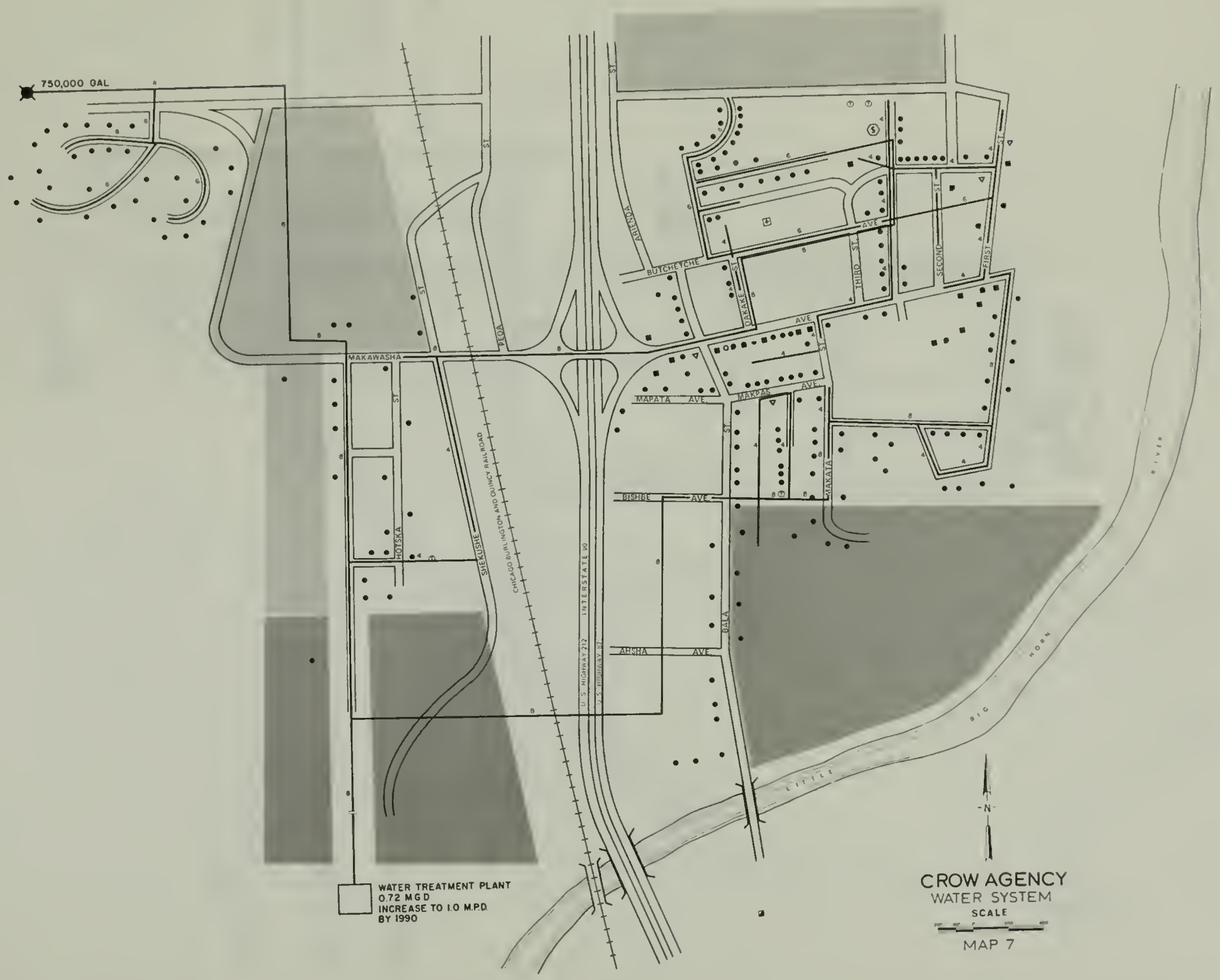
HARDIN
WATER SYSTEM

MAP 5



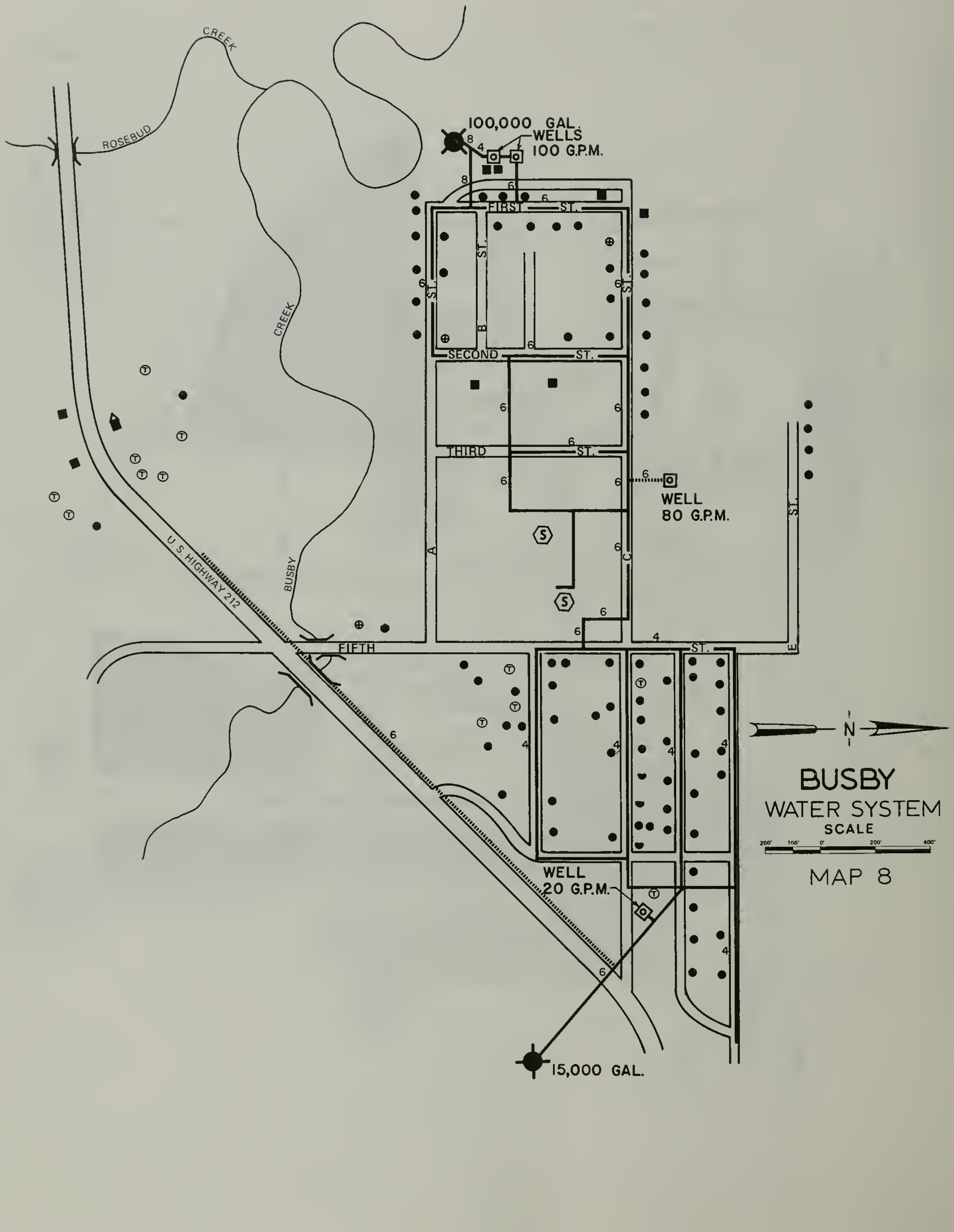
LODGE GRASS
WATER SYSTEM

MAP 6



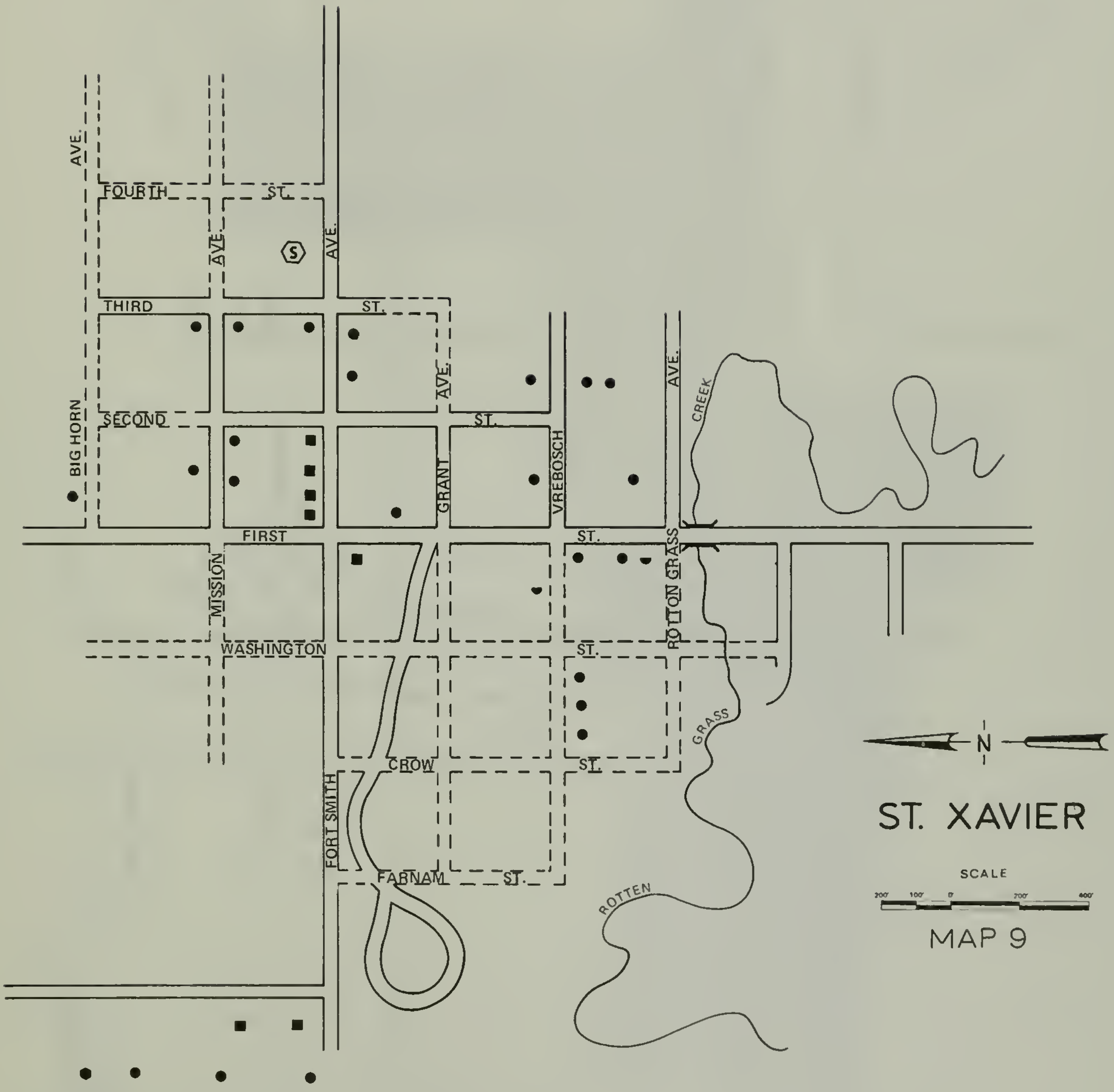
CROW AGENCY
WATER SYSTEM

MAP 7



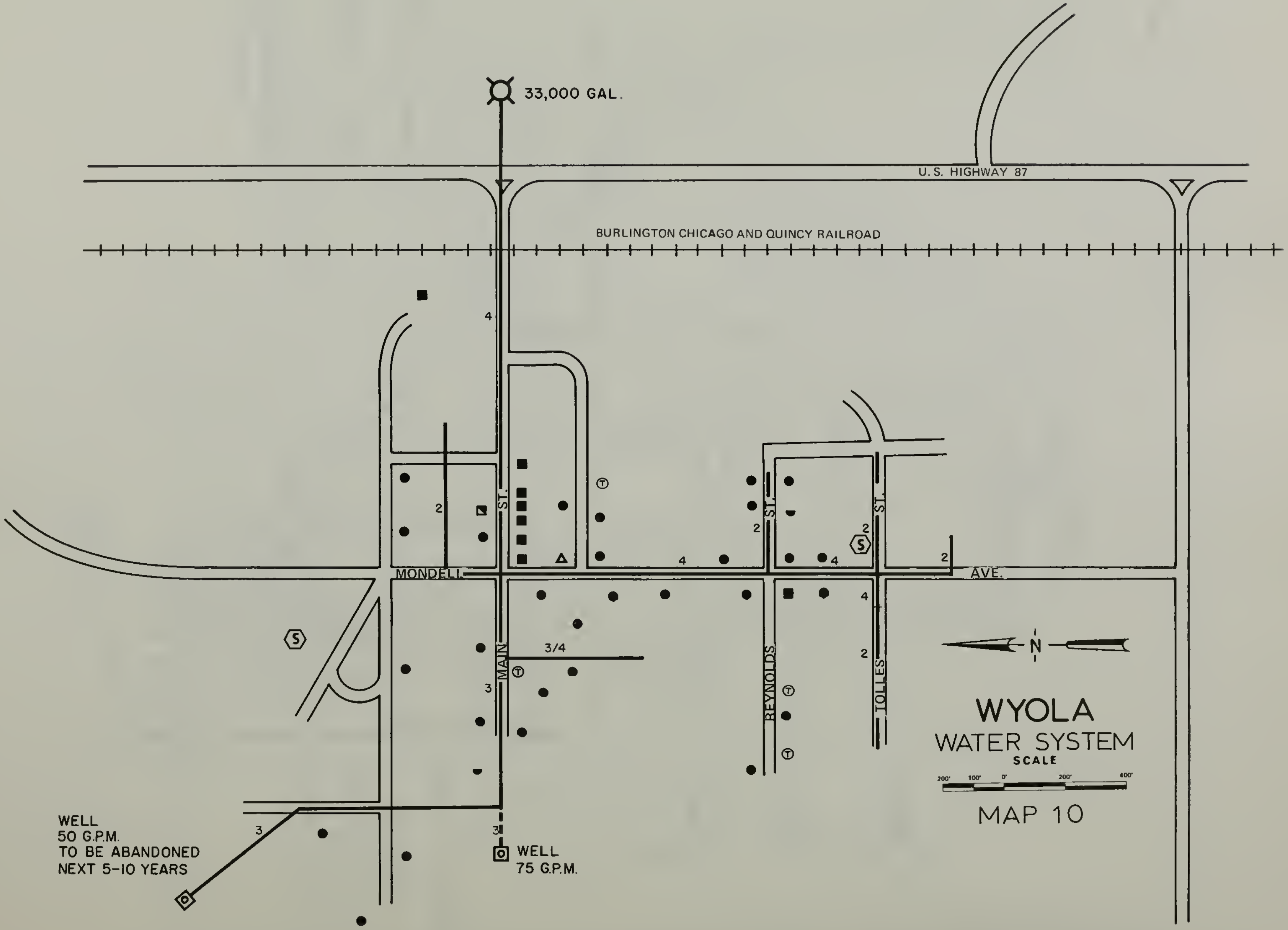
BUSBY
WATER SYSTEM
SCALE

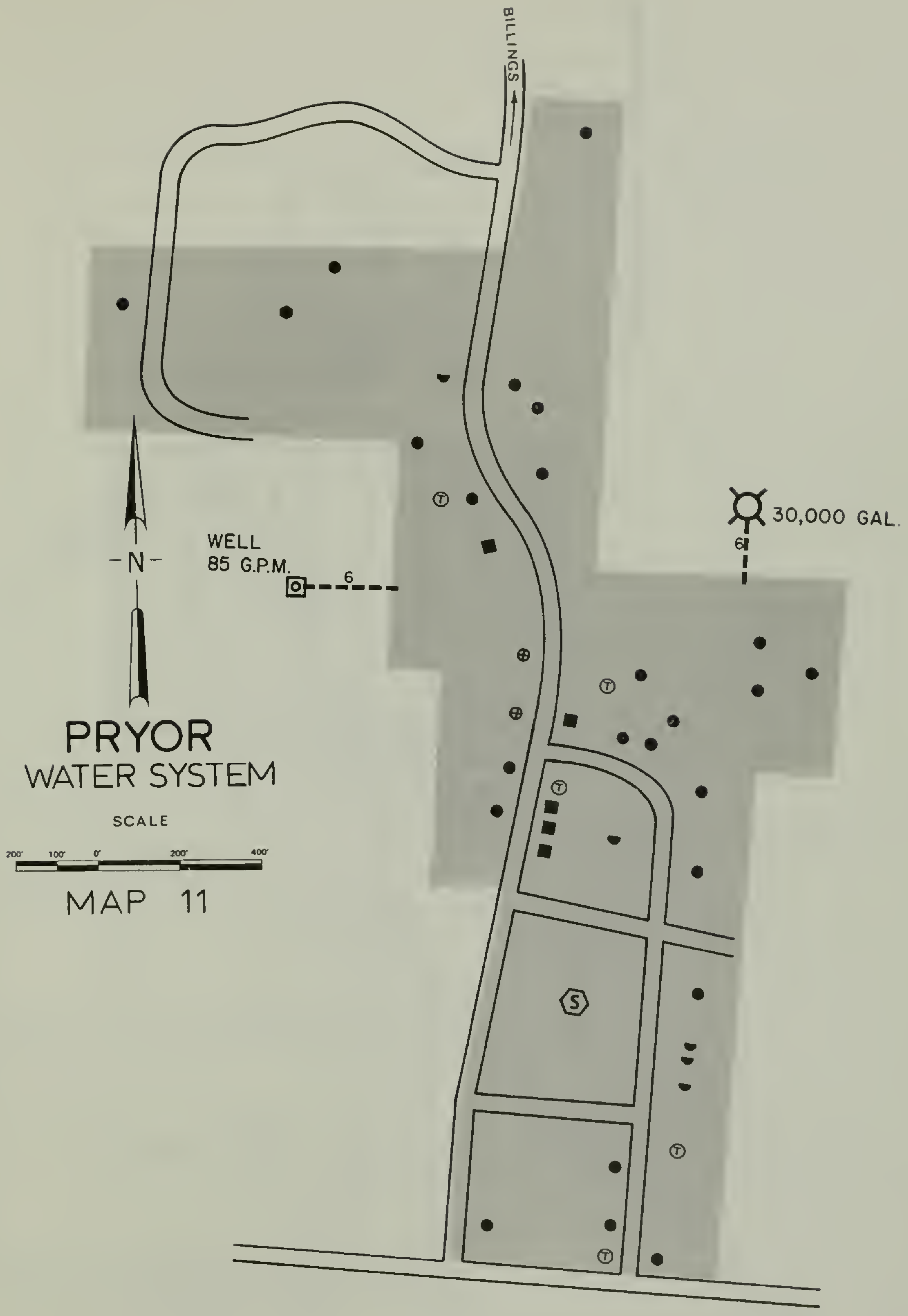
MAP 8



ST. XAVIER

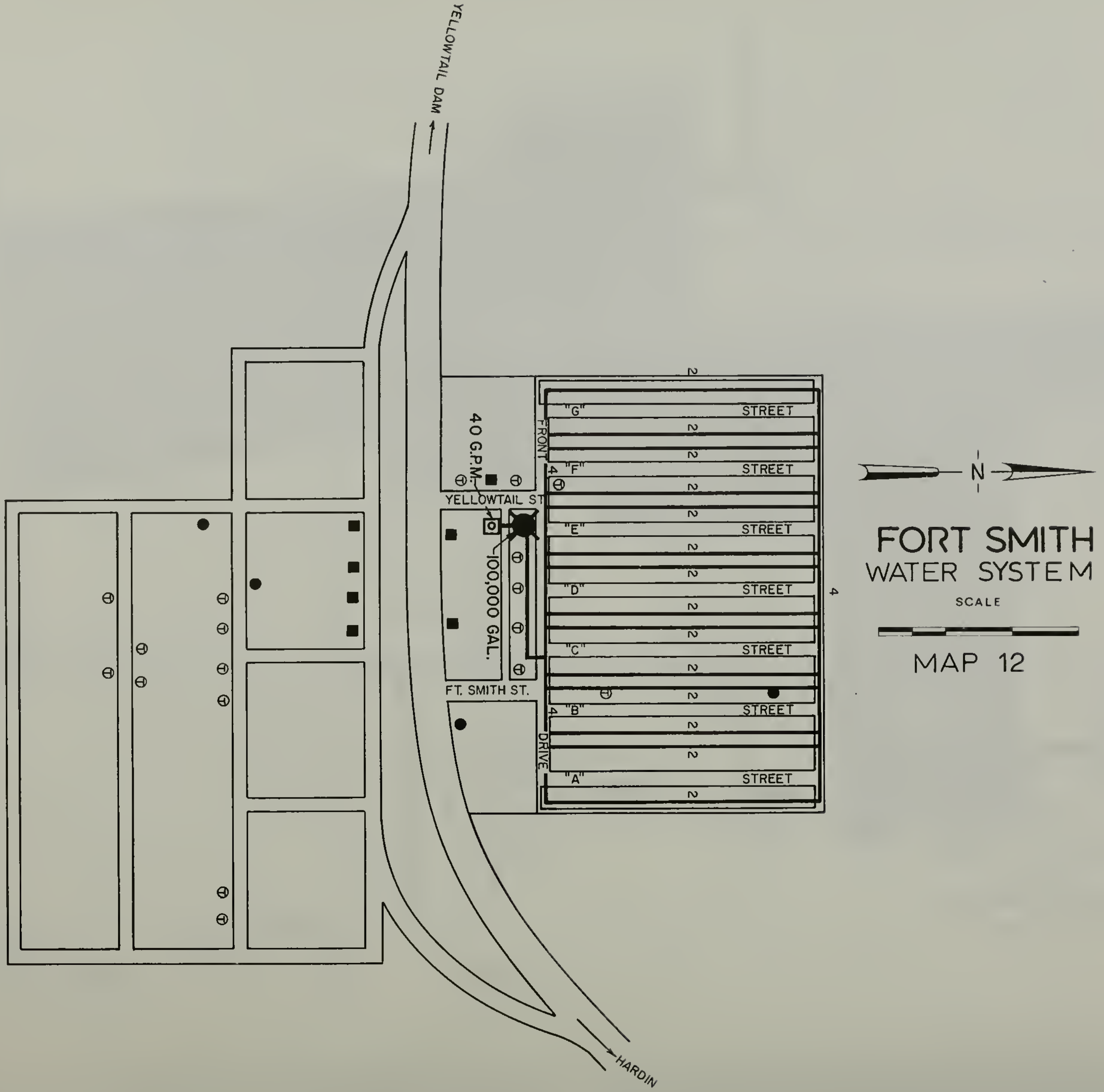
MAP 9


33,000 GAL.
U.S. HIGHWAY 87
BURLINGTON CHICAGO AND QUINCY RAILROAD
MONDELL
AVE.
MAIN
ST.
REYNOLDS
ST.
TOLLES
ST.
4
2
2
4
2
4
2
4
2
3/4
3
3
3
WELL
75 G.P.M.
WELL
50 G.P.M.
TO BE ABANDONED
NEXT 5-10 YEARS
N
WYOLA
WATER SYSTEM
SCALE
200'
100'
0'
200'
400'
MAP 10



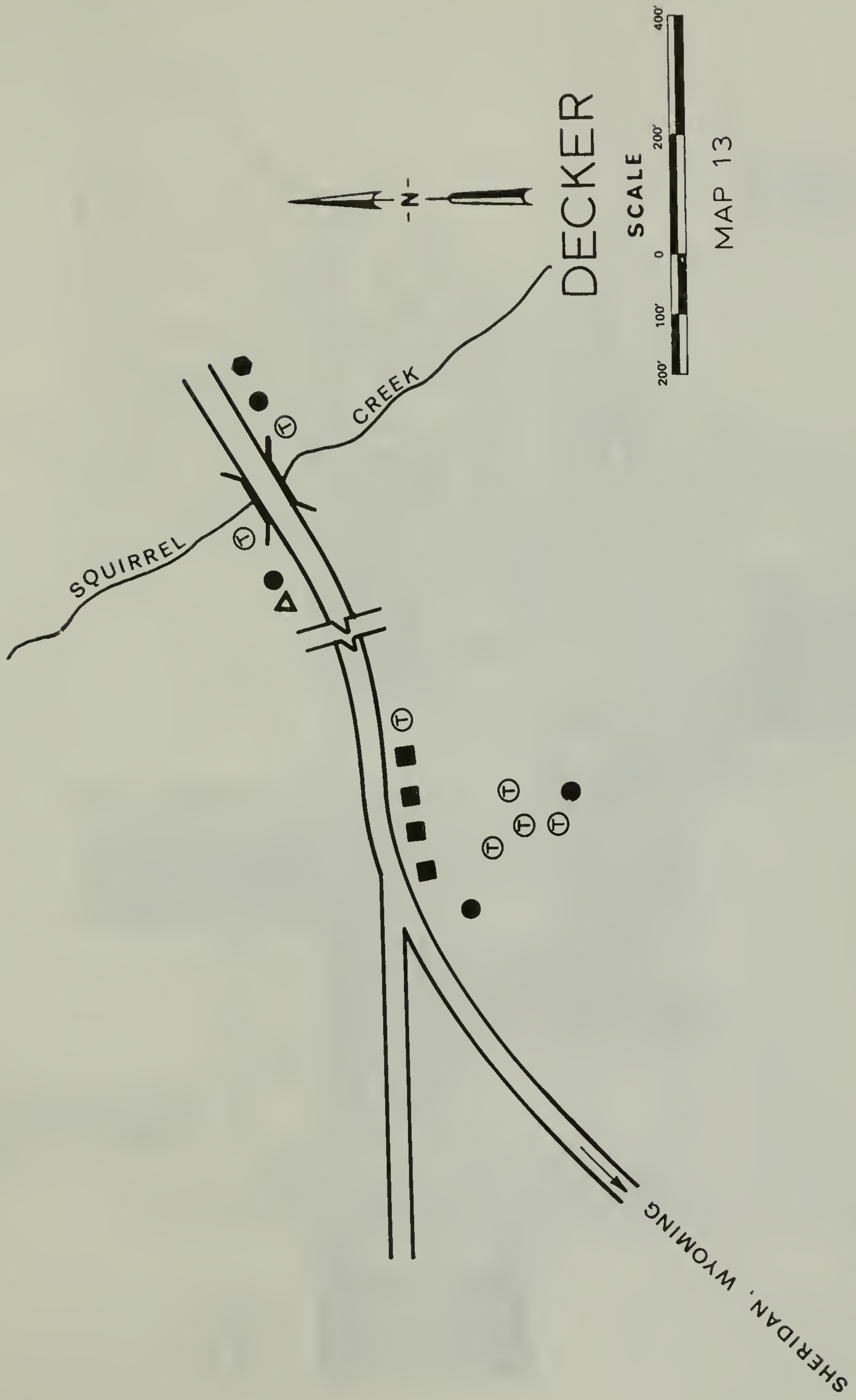
PRYOR
WATER SYSTEM

MAP 11

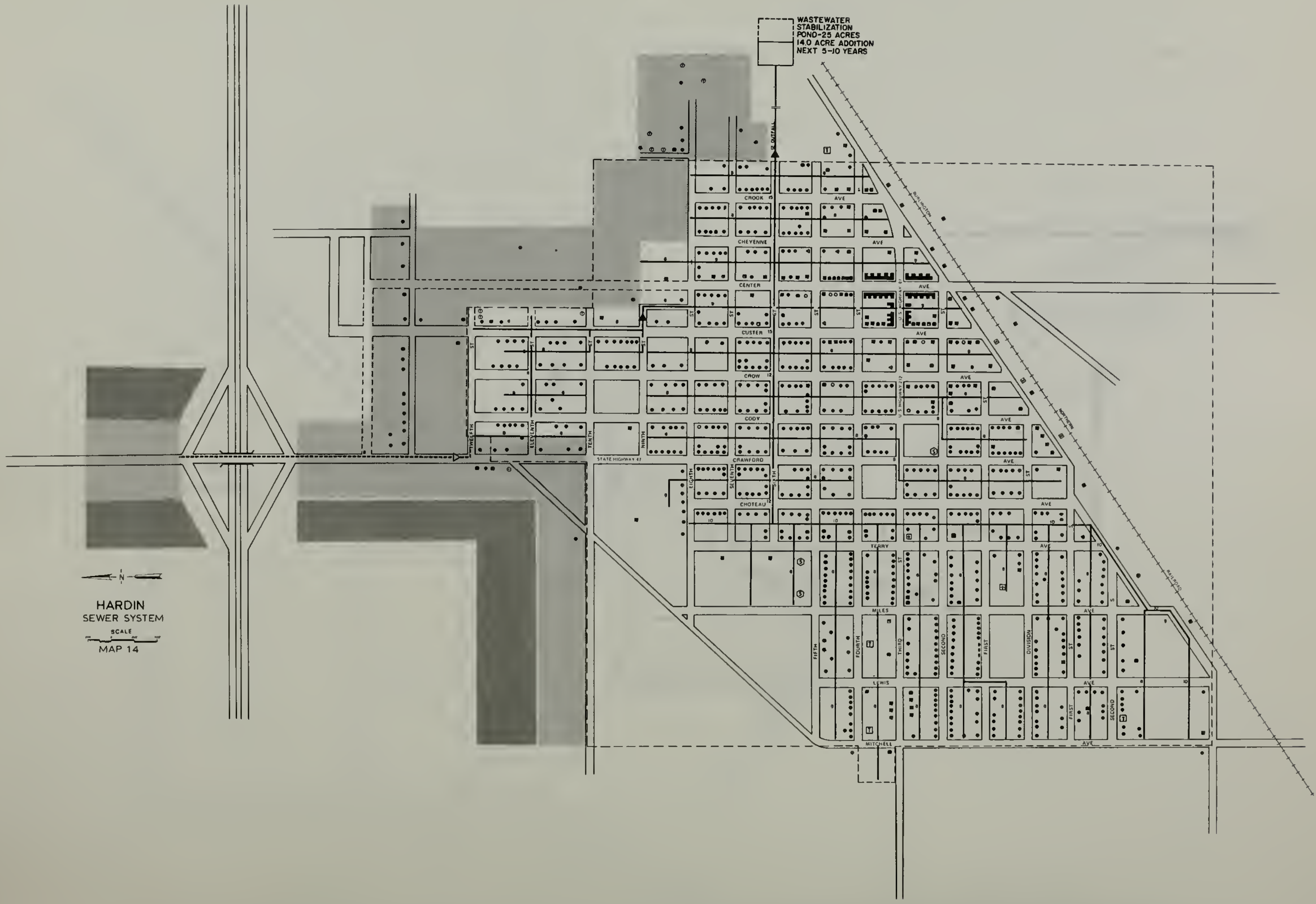


FORT SMITH
WATER SYSTEM

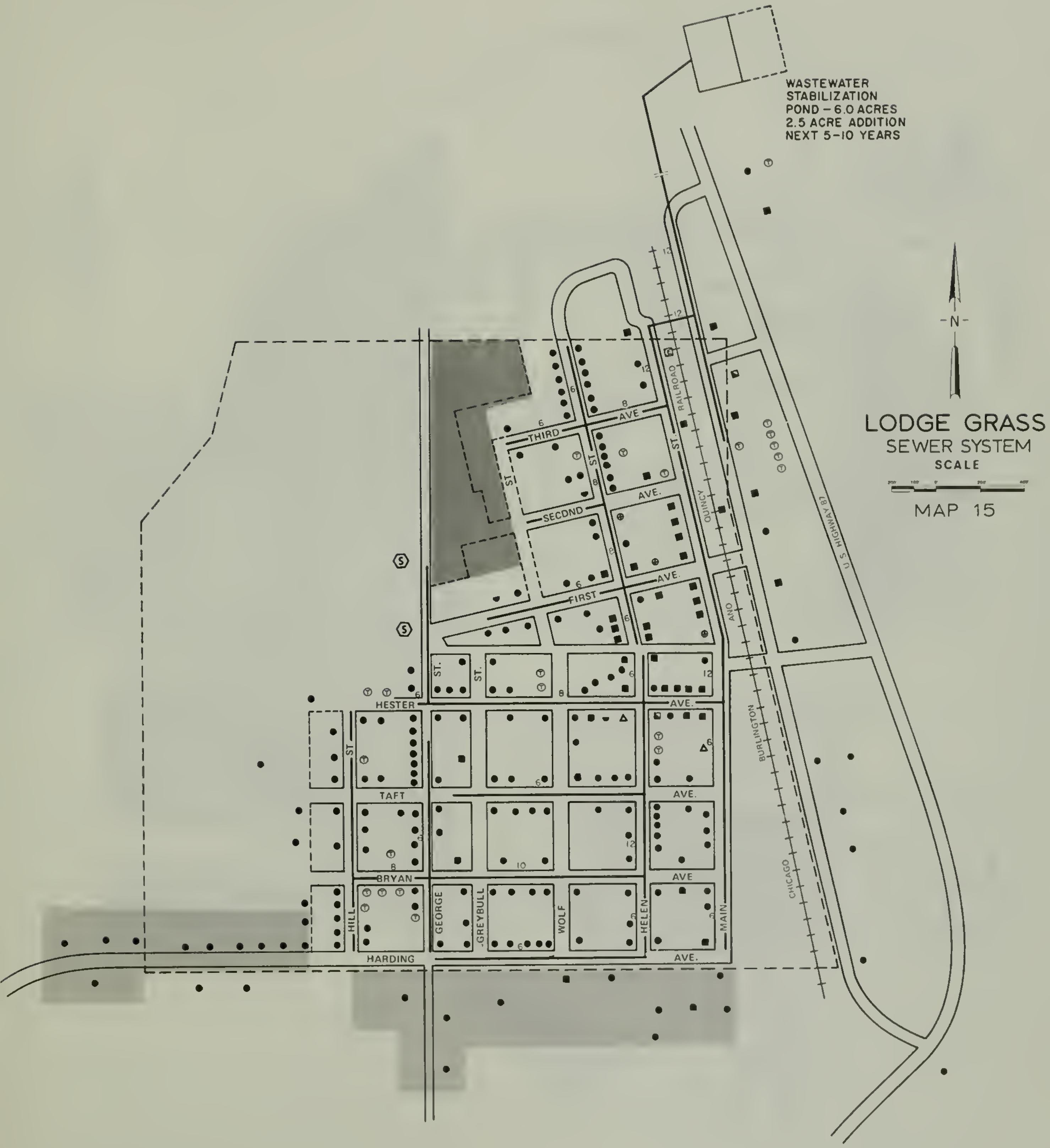
MAP 12


SQUIRREL
CREEK
DECKER
N
SCALE
200'
100'
0
200'
400'
SHERIDAN, WYOMING
T

MAP 13

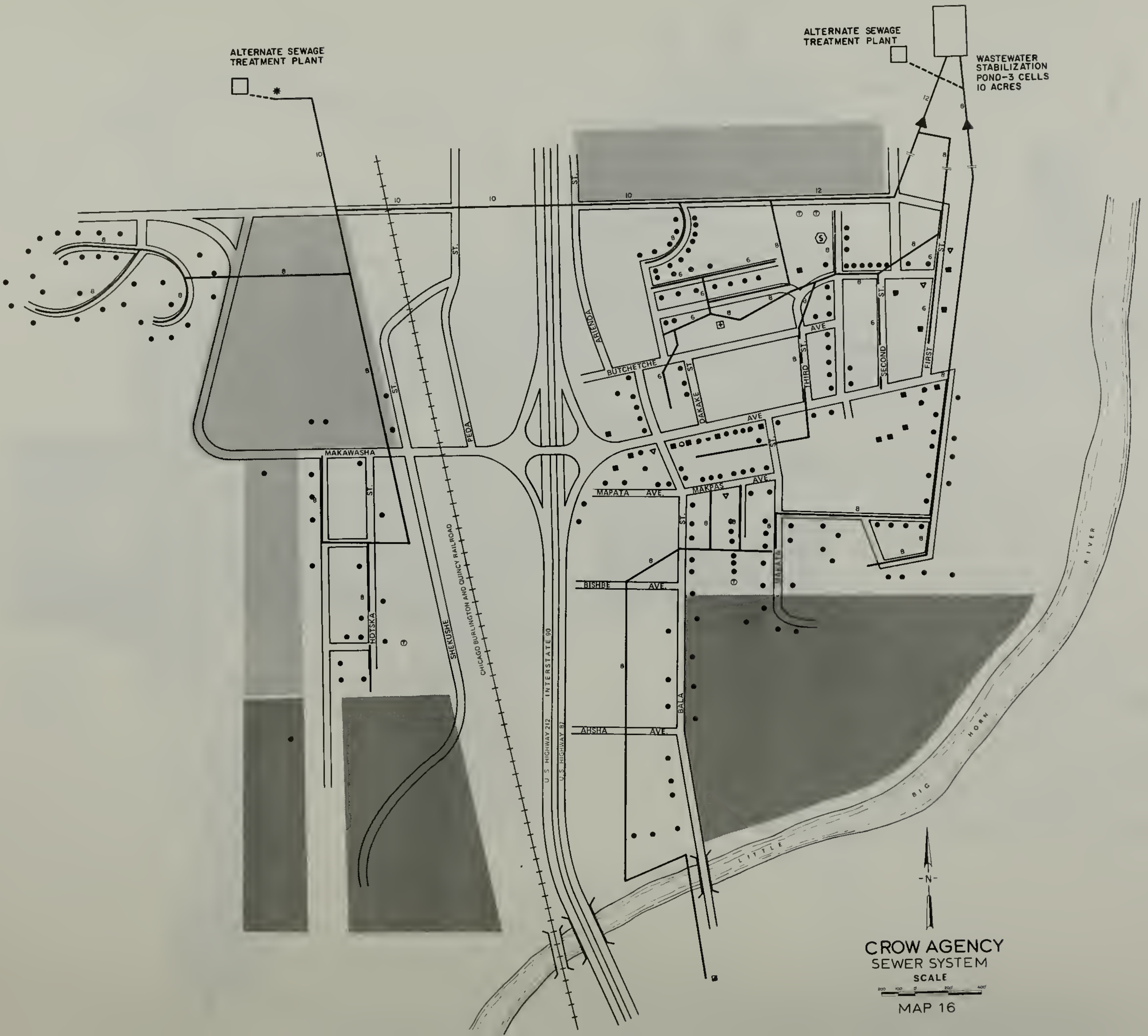


HARDIN
SEWER SYSTEM
SCALE
MAP 14



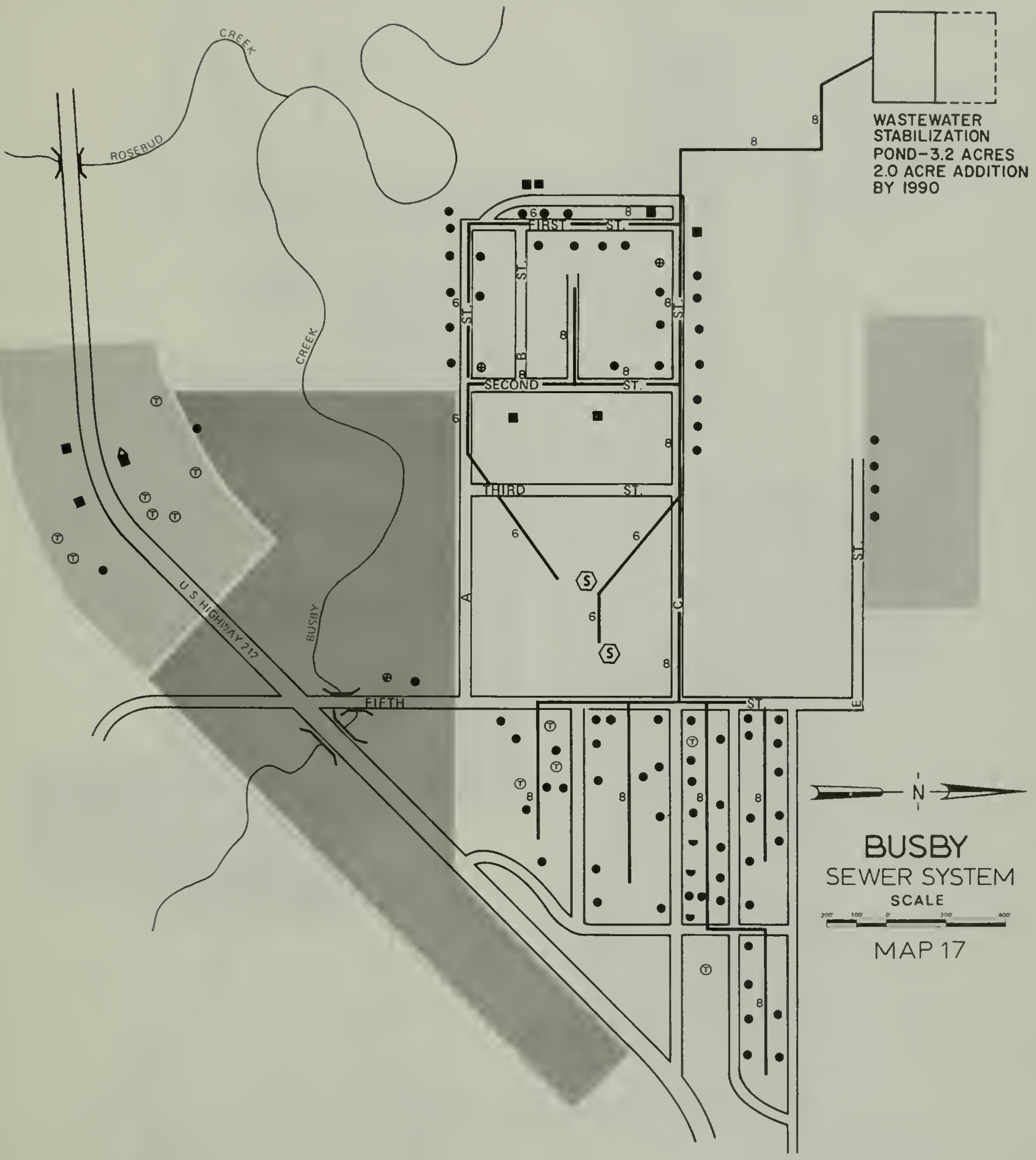
LODGE GRASS
SEWER SYSTEM
SCALE

MAP 15



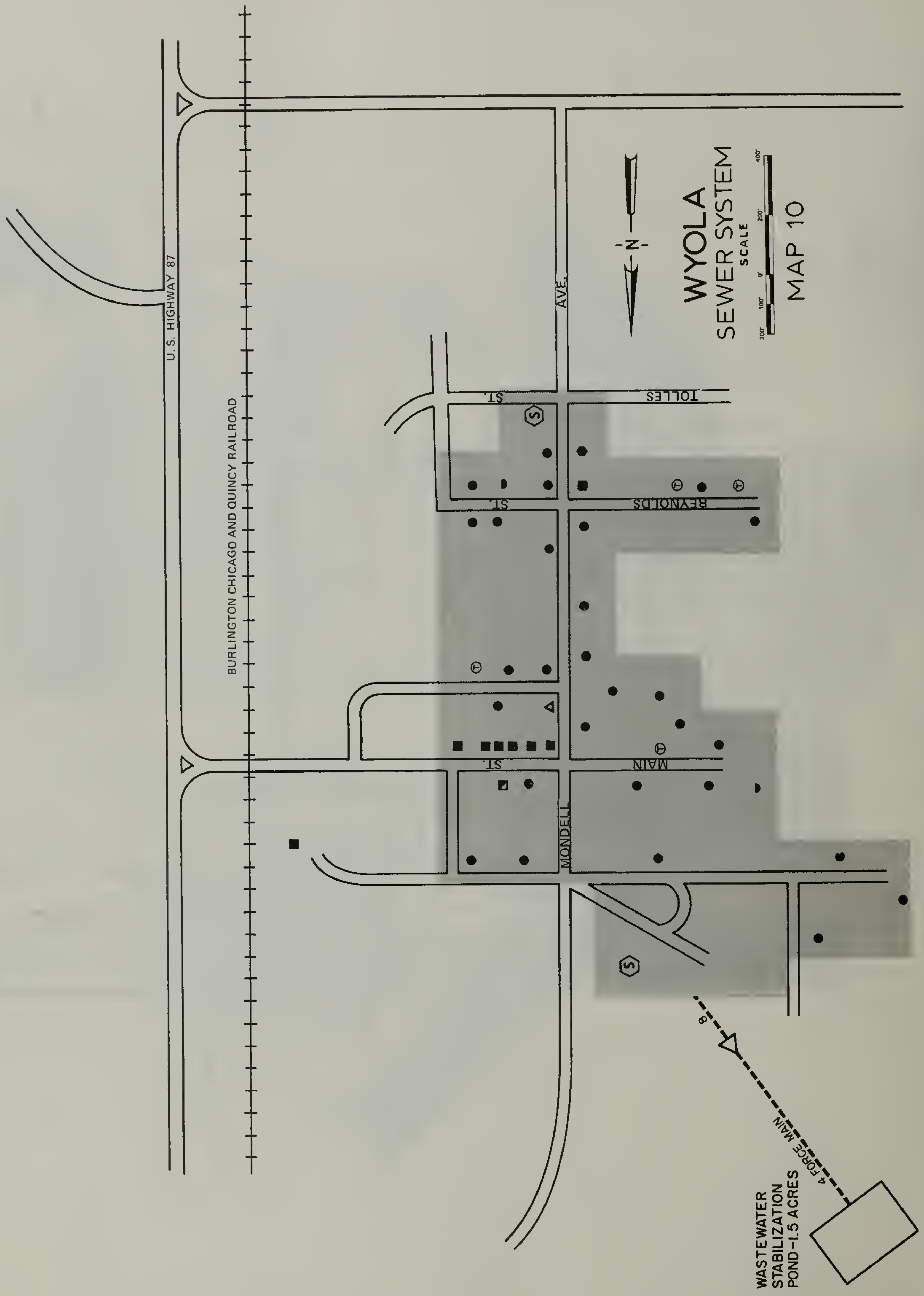
CROW AGENCY
SEWER SYSTEM

MAP 16
]


WASTEWATER STABILIZATION POND–3.2 ACRES 2.0 ACRE ADDITION BY 1990

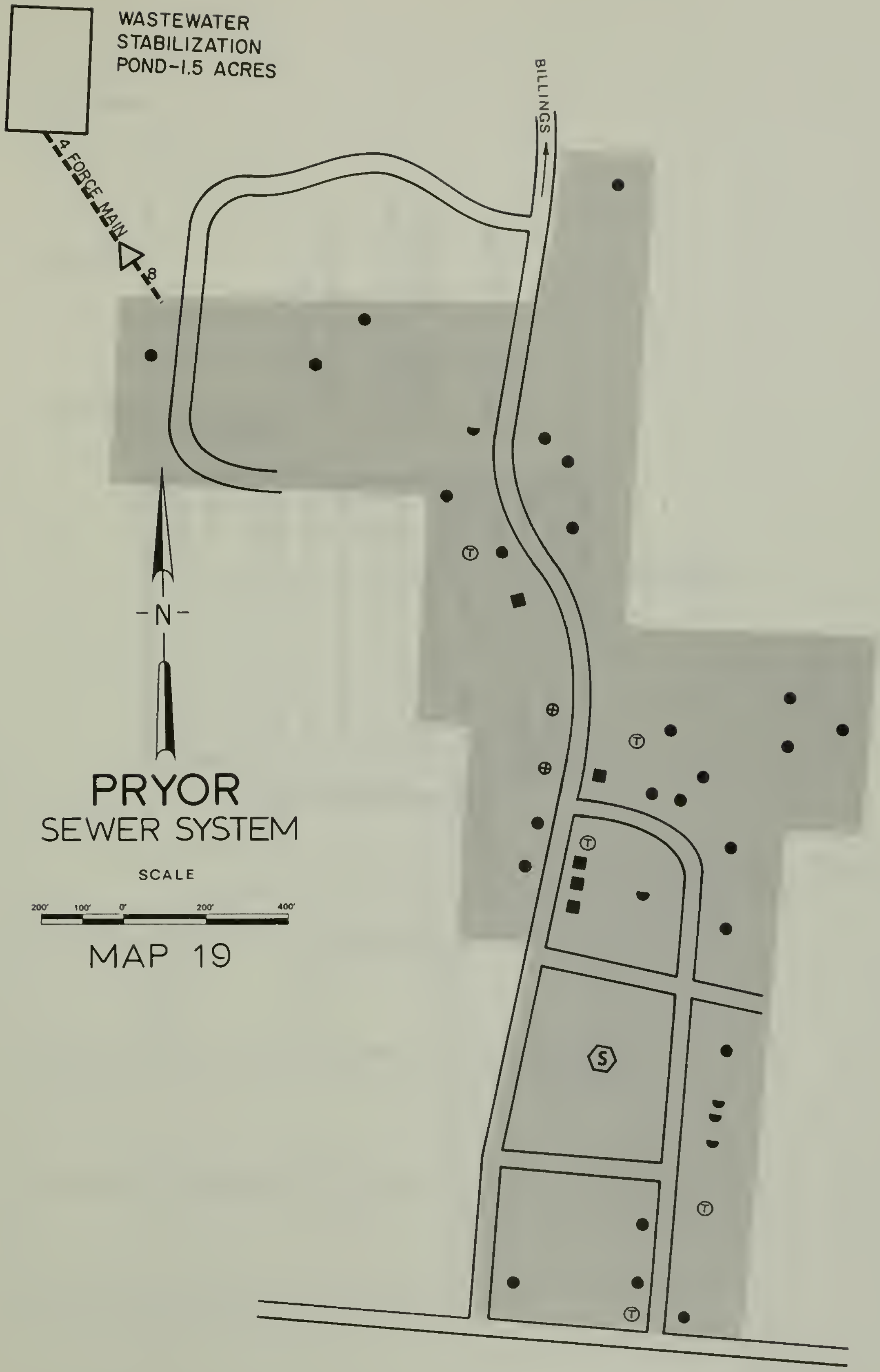
BUSBY
SEWER SYSTEM
SCALE

MAP 17



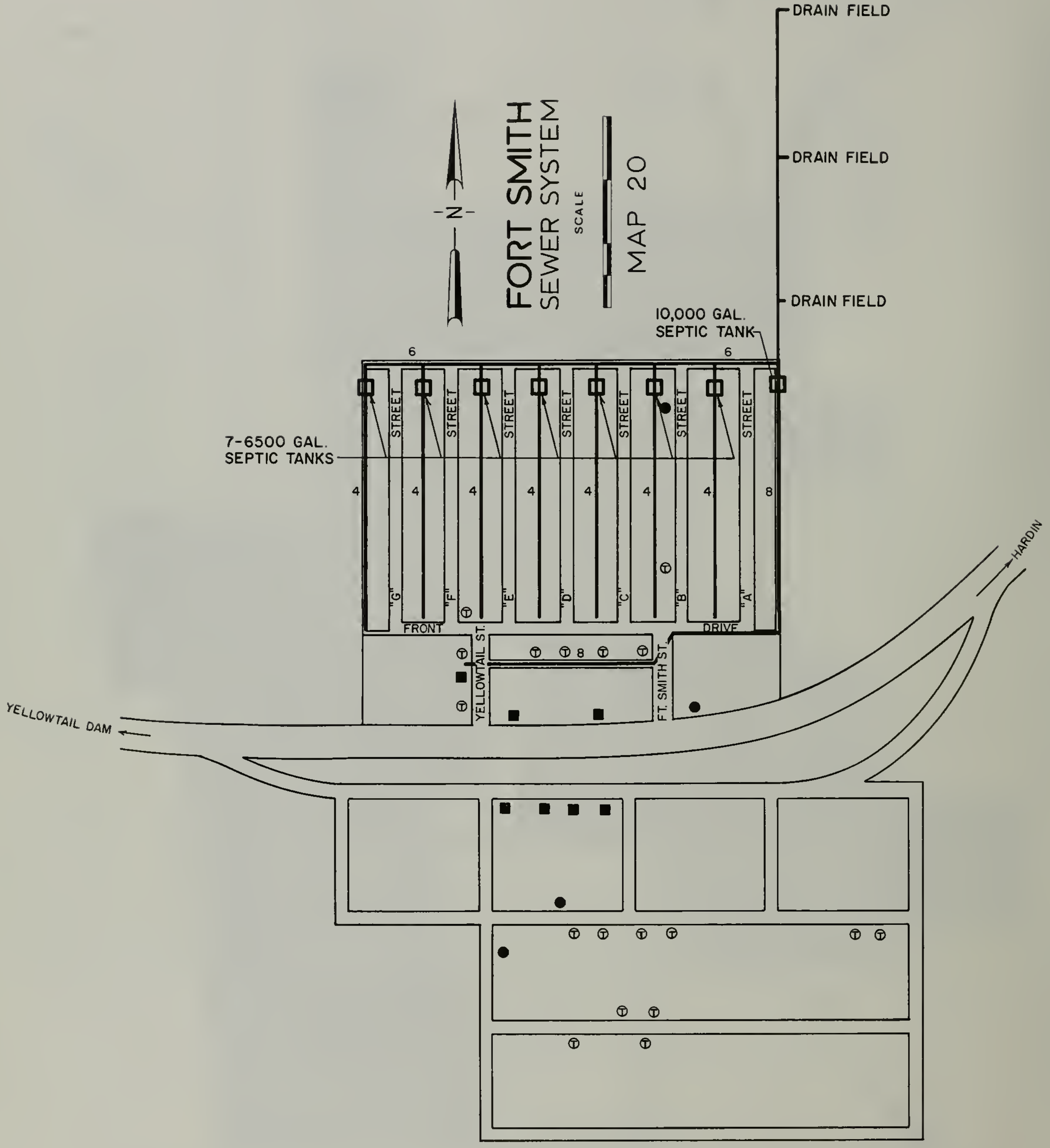
WYOLA
SEWER SYSTEM

MAP 10



PRYOR
SEWER SYSTEM

MAP 19



FORT SMITH SEWER SYSTEM

MAP 20

TREASURE COUNTY

MONTANA

TREASURE COUNTY

MONTANA

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  Recommendations
  Priorities

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CONCLUSIONS

Conclusions

The total population of Treasure County is expected to decrease during the planning period. Hysham, the only community covered in this comprehensive plan, will experience considerable population decrease throughout the planning period. The rural areas of the county will show decreased population as well.

The sanitary facilities presently in operation at Hysham are in generally good condition although some improvements are needed. These improvements consist primarily of maintenance and replacement of deteriorated lines where necessary. System proposals are not necessary for this county since the very small communities presently have less than five users and are outside the scope of this study. Also, major improvements are not necessary for the Hysham system.

Recommendations

This plan shows the various types of improvements which the communities should be considering during the planning period. Elaborate systems are not proposed but rather those facilities necessary to provide safe and adequate community systems. It is recommended that this general plan be adopted by the governing agencies of each community. A detailed approach, which must be undertaken to insure completion of the improvements in each community, cannot be covered in a report of this type. Community leaders, however, do have several courses of action which may be taken.

Most small communities do not have the means to plan and finance complete water and sewer systems. Therefore, to enable communities to acquire such facilities, five departments of the Federal Government have legislation authorizing loans or grants for construction of public works. These agencies are:

Farmers Home Administration
United States Department of Agriculture
P.O. Box 850
Bozeman, Montana 59715

Federal Water Quality Administration
United States Department of the Interior
% Montana State Department of Health
Helena, Montana 59601

Public Health Service
United States Department of Health, Education, and Welfare
Division of Indian Health
Billings, Montana 59101

Administration for Metropolitan Development
United States Department of Housing and Urban Development
Assistant Regional Administrator
Denver Regional Office
1050 South Broadway
Denver, Colorado 80209

Economic Development Administration
United States Department of Commerce
Montana Field Coordinator
207 Medical Arts Building
Butte, Montana 59701

The legislation is constantly changing; therefore, community leaders should investigate the various alternatives and determine which program and course of action would be most beneficial to them.

THE LAND

General Characteristics

Treasure County is located in the south central portion of the State of Montana and is bordered by Rosebud County, which forms the north and east boundary, and Big Horn and Yellowstone Counties, which form the south and west boundaries respectively. The total area of the county is 997 square miles of which thirteen square miles represent water surface area.

As seen from the topography on Map 1, Treasure County is characterized by rugged hills in the southern portion of the county, rolling plains in the north, and a broad river valley lying between these two areas. Elevations vary from nearly four thousand feet in the southeastern corner of the county to elevations as low as 2,600 feet in the northeastern area where the Yellowstone River leaves the county. The population is generally distributed within the Yellowstone River valley.

Interstate Highway 94, which is also U. S. Highways 10 and 312, extends east and west through the approximate center of the county and leads eventually to Billings in the west and Miles City in the east. Montana State Highway 311 originates at Hysham and traverses westward to Myers before crossing the Yellowstone River where it connects with two county roads that serve the northern areas of the county. Dirt and gravel roads serve the more outlying areas.

Rail transportation is provided by the southern main line of the Burlington-Northern Railroad which generally parallels Interstate 94 and the Yellowstone River. Several daily freight trains pass through the county, thus providing access with western and midwest markets. The freight transportation service provided is of particular economic importance to the agriculture industry of the county. The North Coast Limited and the Mainstreeter also travel through the county four times daily providing passenger service to both eastern and western regions.

Although there are no commercial airports in the county, daily air services and connections to nation wide airlines are available at Billings and Miles City. Hysham does, however, have a good, three thousand foot, unpaved, public airport installation; aircraft servicing facilities are minimum, however.

The Mid-Yellowstone Electric Cooperative provides power service to Treasure County. The cooperative, headquartered at Hysham, purchases power from the United States Bureau of Reclamation which is part of the Northwest Power Pool, and thus makes the possibility of a power shortage in the area quite remote.

Since major power producing centers and relay stations are usually located at widely separated points and provide power service to large areas, Map 2 shows the major power grid system for the entire State of Montana. Major gas transmission lines are also shown.

Telephone service is provided by two telephone companies. The Hysham Telephone Company provides service to Hysham, Sanders, Myers, and a portion of the Big Horn areas as well as the rural areas of the southeastern third of the county. The Intermountain Telephone and Power Company, centered in Yellowstone County at Custer, serves the rural portions just south of Big Horn along the Big Horn River valley.

Land Ownership and Use

As seen on Chart 1, there are three main types of landowners in Treasure County. The largest segment of land, eighty percent, is privately owned. Fourteen percent is owned by the federal government, and in most cases the land is administered by the Bureau of Land Management. The remaining six percent, or sixty two square miles, is state owned.

CHART 1

Land Ownership
Treasure County

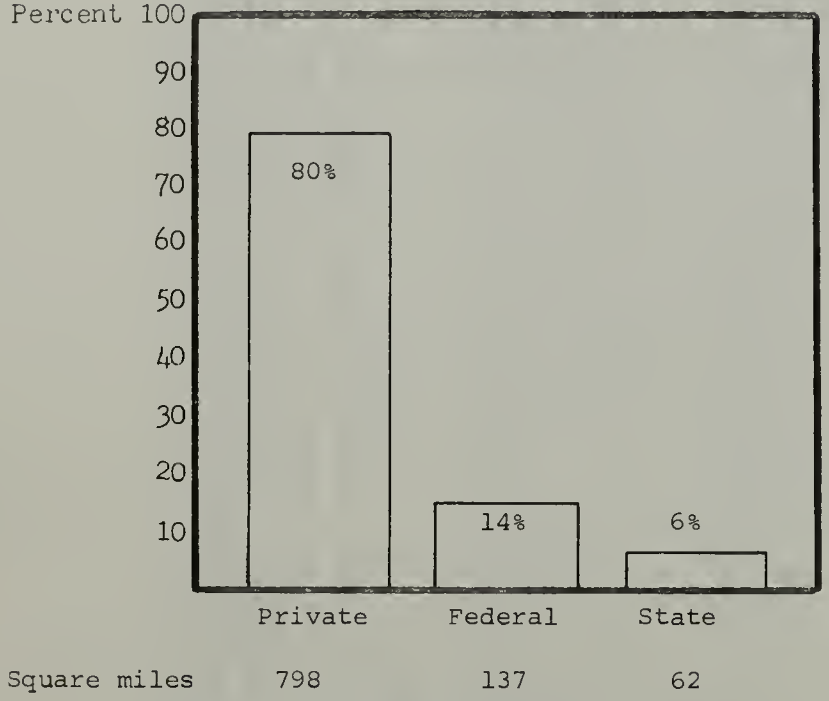
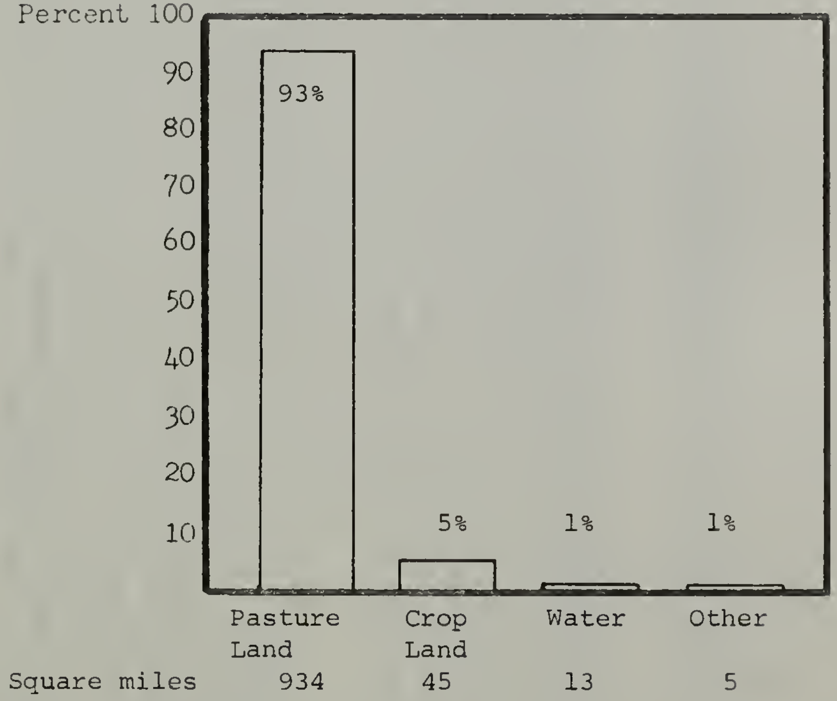


CHART 2

Land Use
Treasure County



Source: The Montana Almanac, 1950-60

Land use in the county is reflected by the general physical characteristics of the area. Over nine tenths of the land is used for grazing with the largest share of the remaining portion, five percent, consisting of cropland along the Yellowstone River valley. The primary crop production by acres is alfalfa hay, winter wheat, alfalfa seed, sugar beets, barley and corn. Thirteen square miles of water surface area exist and are to a large part made up of the meandering Yellowstone River. The remaining one percent of the land surface is utilized by townsites, transportation, and similar purposes not included in the above general categories.

Natural Resources

Sand and gravel are the most important natural resources in Treasure County. In 1966, $489,000 worth of sand and gravel were extracted while in 1967 the amount was reduced to $11,000. The primary use of this resource is for road materials, and only seven percent is used for building materials.

Bentonite is also found in the area. This clay material is mined in the northeastern corner of the county near Vananda at the Hallett Minerals Pit, owned and operated by Hallett Minerals of Duluth, Minnesota.

Coal is found in the western and southeastern portions of the county. The western area is part of the Bull Mountains coal field while the southern area is an extension of the Fort Union coal region. Both areas produce a sub-bituminous rank coal with an estimated reserve of 1,303.66 million short tons. Because of the limited utilization and demand, it is not presently feasible to mine this resource.

Recreational opportunities in the area are greatly enhanced by the variety of natural landscaping. Antelope are found on the rolling plains of the northern portions while whitetail and mule deer are common in the more wooded, rugged areas of the south. The Yellowstone River, winding through the center of the county, is noted for cat fishing. The Yellowstone also offers other water related sports such as swimming and boating.

Soils

The soils of Treasure County are generally of the agriculture supporting type. The vast majority support a substantial grass growth and are utilized for grazing and pasture lands. Where the topography of the land allows, strip farming is undertaken, and the soils along the Big Horn and Yellowstone Rivers are often irrigated and support hardy stands of sugar beets, barley, corn, alfalfa seed, hay, and oats. The soils in the southern half of the county are more rugged and support tree growth. This area is also traversed by many small creeks that have cut deep gullies in the terrain.

A more detailed description of the soils will be covered later in this report.

Water

The Yellowstone River, running west to east through Treasure County, is the primary drainage system for the entire area. The northern portion of the county drains southeast into the Yellowstone, and the southern portion drains northward into the Yellowstone. The Big Horn River forms a small portion of the western boundary of the county before flowing into the Yellowstone River. All the waters from Treasure County are part of the Missouri River Basin drainage system.

Water resources are covered in more detail later in this report.

THE PEOPLE

Population

For analytical and projective purposes, it is necessary to study the population history of Treasure County to determine what has happened and what is going to happen. Chart 3 graphically shows the growth of the county as compared with that for Montana and indicates the future growth for both.

The number of persons in the county has steadily decreased since 1920. Until the 1960's the largest loss in population occurred during the 1920's. The decade of drought and depression actually had smaller losses than those recorded ten years earlier and thirty years later. The estimated 1970 population is half of that for 1920. The projected 1990 number drops to forty three percent of the earlier figure.

Treasure County was classified as a peripheral metropolitan, or suburban place, in 1960 in that it was located adjacent to but not a part of a Standard Metropolitan Statistical Area. Chart 1 indicates the population changes that have occurred within the urban, farm, and rural non farm areas of the county. During the 1950's the number of persons in the urban areas increased while a decline occurred in the rural portion of the county. Within the rural areas, the rate of decline was greater for the non farm population than for the farm

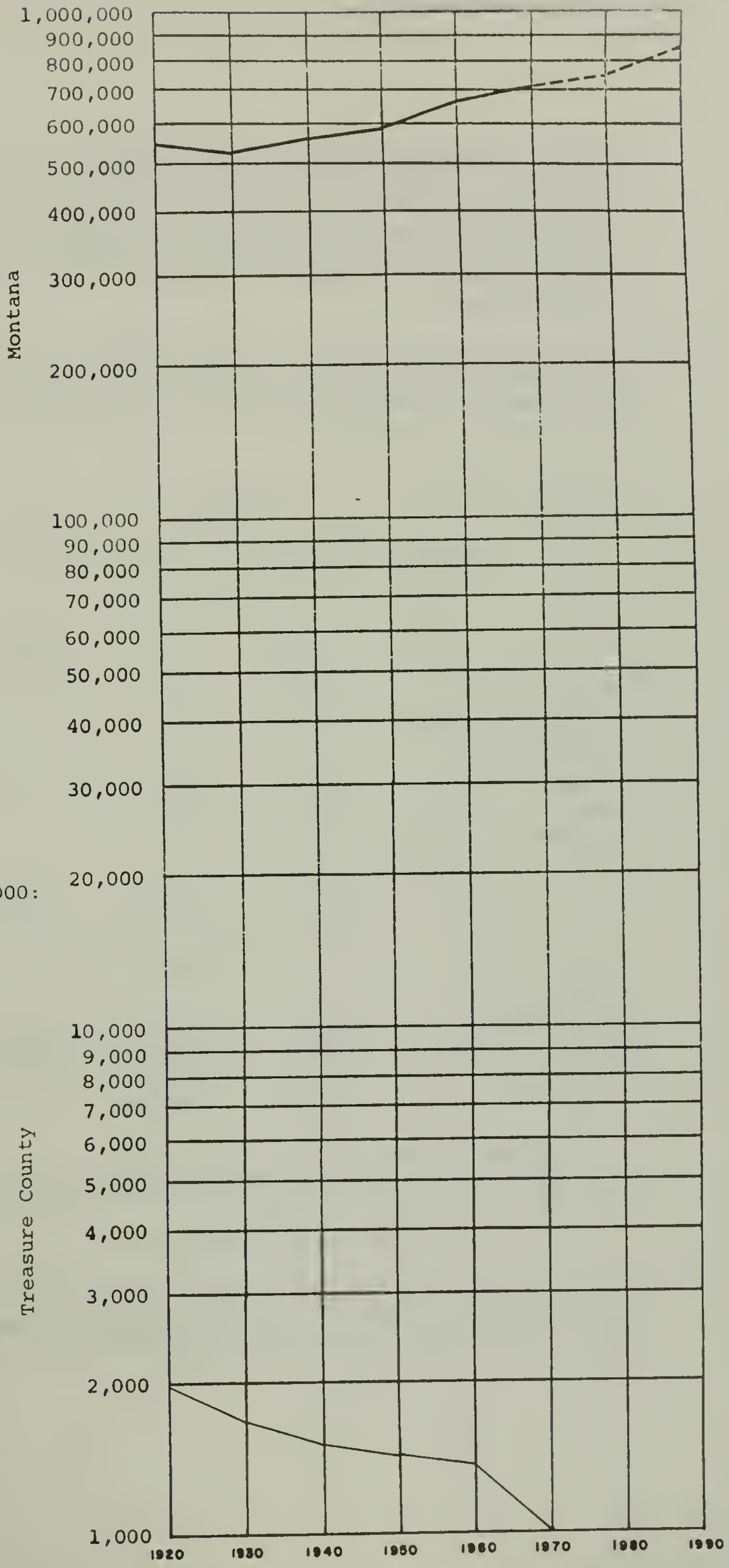
CHART 3

COMPARATIVE POPULATION TRENDS

Treasure County
and Montana

NOTE: Projected populations for the county are below 1,000:

for 1980, 900
for 1990, 850



Sources:

1. U.S. Census of Population
2. Intermountain Planners, Inc.

areas. From 1960 to 1970 losses occurred within all segments of the population. Over the twenty year reporting period persons in urban areas have increased as a part of the total population. This group represented twenty nine percent of the total in 1950, advanced to thirty seven percent in 1960, and to a present forty five percent. The percentage for the farm group declined as did that for the rural non farm element.

During the period from 1950 and 1960 the county experienced a population loss of fifty seven persons. Chart 4 indicates that the decline is a result of a net migration loss of 297 persons and an excess of 240 births over deaths.

TABLE 1

Urban-Rural Population Changes for Treasure County
1950-1970

	1950	1960	Changes Number	1950-1960 Percent
Total	1,402	1,345	- 57	- 4.1
Urban (Inc. Towns)	410	494	+ 84	+20.5
Rural	992	851	-141	-14.2
Farm	829	764	- 65	- 7.8
Non Farm	163	87	- 76	-46.6

	1960	1970	Changes Number	1960-1970 Percent
Total	1,345	1,000	-345	-25.7
Urban (Inc. Towns)	494	450	- 44	- 8.9
Rural	851	550	-301	-35.4
Farm	764	500	-264	-34.6
Non Farm	87	50	- 37	-42.5

Sources: 1. U. S. Census of Population, 1950-1960

2. Intermountain Planners, Inc.

The 1950 to 1960 change in sex composition is shown in Chart 5. Over the ten year period the ratio centralized with a resulting slight preponderance of males over females. This ratio is expected to remain throughout the twenty year planning period.

The age distributions by sex for 1950 and 1960 are shown in Table 2. As indicated, losses occurred within most age groups.

TABLE 2

Age & Sex Composition of Treasure County

	1950		1960	
Age Group	Male	Female	Male	Female
Under 5	121	81	89	107
5-14	140	134	178	143
15-19	65	46	48	39
20-24	47	40	31	45
25-34	103	96	87	77
35-44	88	88	78	76
45-54	79	48	73	66
55-64	58	59	54	33
65-74	50	26	32	39
75 +	26	7	34	16
Total	777	625	704	641

Source: U. S. Census of Population, 1950-1960

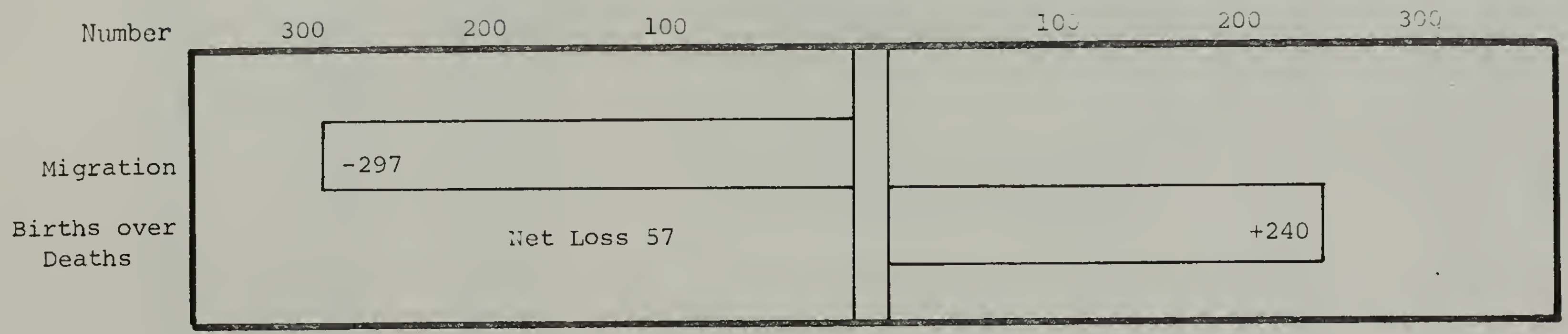
The incorporated town of Hysham is the only urban place included in the study of Treasure County. The communities of Big Horn, Myers, and Sanders were studied but were not included in this report because of insufficient population and development.

Because of the time that has passed since the 1960 Census, current population estimates had to be derived from several sources in the field. Surveys and interviews were conducted to determine what now exists and what is expected in the future.

Table 3 indicates the past population experience and the future forecast for Hysham. As indicated, the number of persons in the town will decrease by almost seventeen percent over the next twenty years.

CHART 4

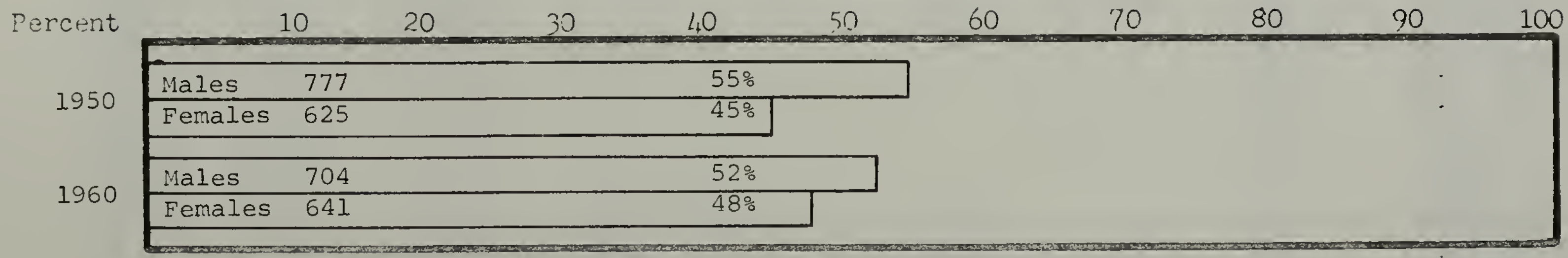
Population Change
Treasure County 1950 - 1960



Source: Net Migration of Population, 1950-1960 by Age, Sex, and Color,
U. S. Department of Agriculture

CHART 5

Population by Sex
Treasure County 1950 - 1960



Source: U. S. Census of Population, 1950-1960

TABLE 3

Population Forecast for the Town of Hysham

Treasure County

	1950	1960	1970	1975	1980	1990
Hysham	410	494	450	425	400	375

Sources: 1. U. S. Census of Population, 1950-1960

2. Intermountain Planners, Inc.

The population figures reflect only those factors and trends for which information is available. New technological advances, new industries, or other unforeseen events may alter these projections. If such an event occurs, Hysham or any other areas should be studied in light of the new conditions.

Housing

There were 443 housing units in Treasure County in 1960. Fifty nine percent of all units were of the rural non farm type while, according to Chart 6, forty one percent represented farm housing units. Since Treasure County lacked any recognizable urban center in 1960, there was no urban classification of housing units as found elsewhere in Montana. The median housing unit size was 4.40 rooms per unit, and the median household size per occupied unit was 3.56 persons. Of those units, just more than half were owner occupied while one third were used for rental purposes. Chart 7 indicates that fifteen percent were vacant. The condition of housing in 1960 is reflected in Chart 8 which indicates that thirteen percent were in need of replacement while twenty six percent needed repair. The remainder were classified as sound.

Chart 9 reflects the 1960 status of housing units in terms of source of water, water supply, and method of sewage disposal. For geographical reference, the data shows the status for Treasure County as a whole and for the farm and rural non farm housing units.

In 1960 forty two percent of all housing units were served either by a

HOUSING
Treasure County 1960

Chart 6
Housing Classification

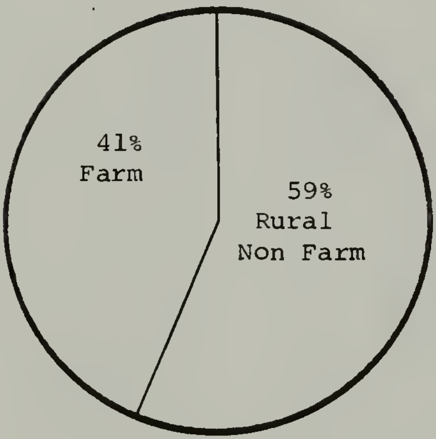


Chart 7
Housing Tenure

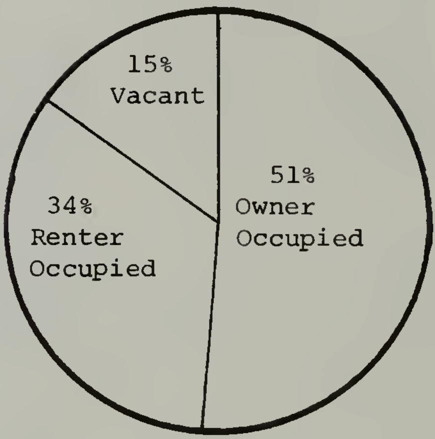
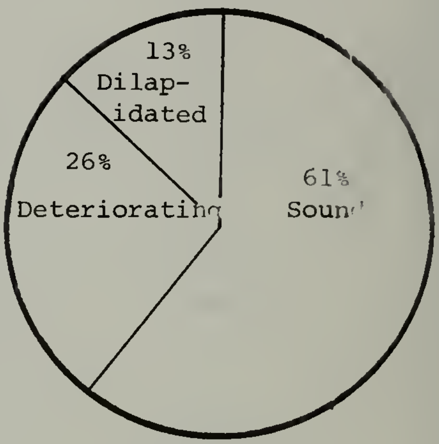


Chart 8
Housing Conditi



Source: U. S. Census of Housing, 1960

public water system or by a private company. Those served included seventy percent of the homes in rural non farm areas and four percent of the farms. Almost three of every four farms relied on individual wells for water as did one home in seven in the rural non farm areas. Almost one fifth of all housing units relied on some other source for water.

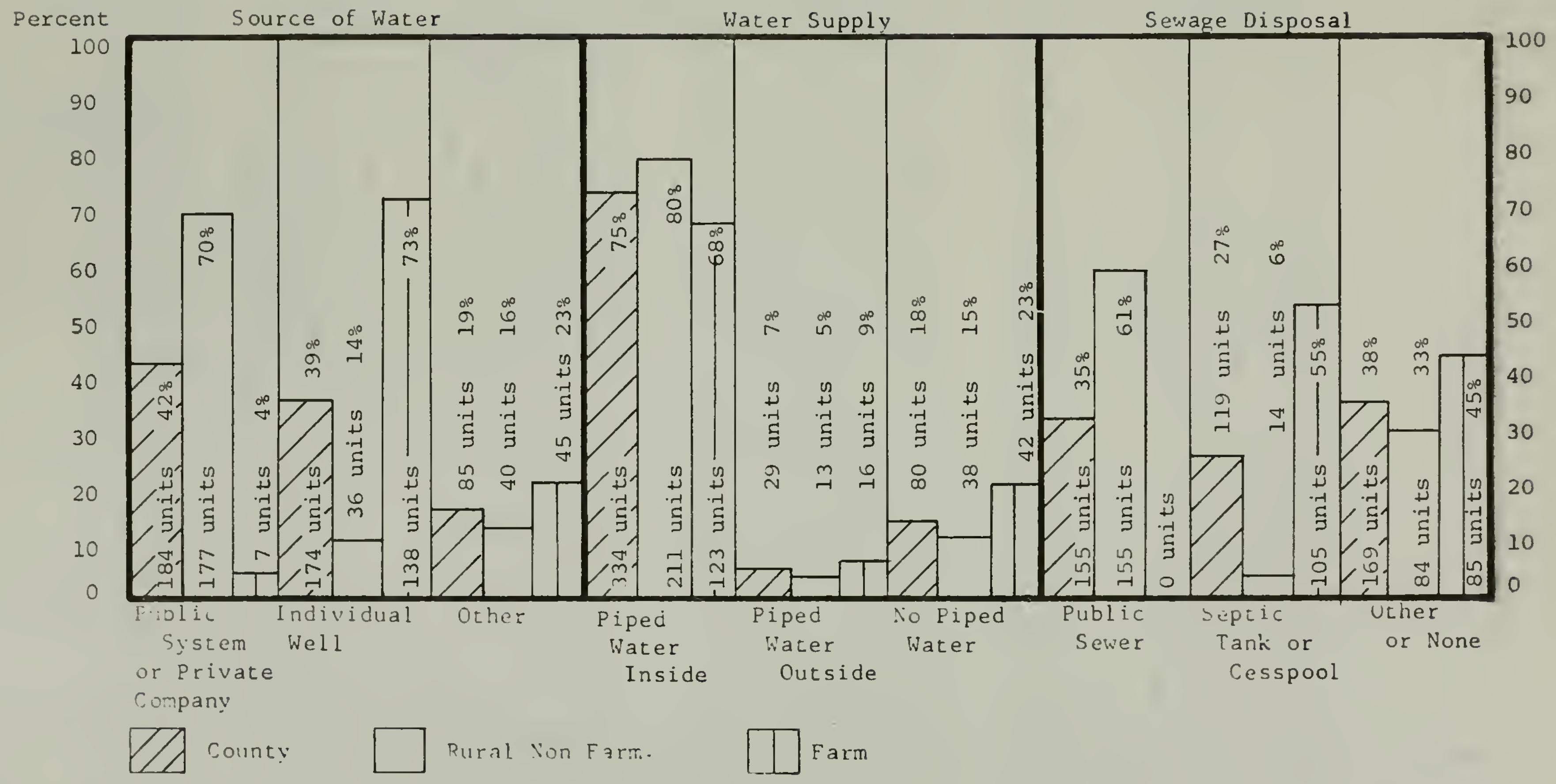
Eighteen percent of all homes did not have piped water in 1960. The category included fifteen percent of the homes in the rural non farm areas and twenty three percent of all farms.

One third of the homes were connected to a public sewer in 1960. The list includes almost two thirds of the rural non farm homes and none of the farms. Just over half of the farms in addition to six percent of the rural non farm homes used either a septic tank or a cesspool for sewage disposal. Over one third of all homes, which included one third of the rural non farm homes and forty five percent of the farms, relied on still another method for sewage disposal.

The rural non farm category includes homes in the small urban areas of the county. The housing data indicates that some public facilities are lacking in these areas and should be provided.

CHART 9

Sewer and Water
Treasure County 1960



Source: U. S. Census of Housing. 1960.

THE ECONOMY

Labor

People have a direct relationship on the economy of an area because of their role as both producers and consumers of goods and services. The following economic analysis of Treasure County is concerned primarily with the total economic spectrum and how it may affect the future of the area. Changing economic conditions can have either a good or a bad effect in terms of population growth, ability to provide for public improvements, or in determining the general overall living environment.

Between 1950 and 1960 employment in the county declined by eighteen percent while the population dropped by only four percent. The decline in the labor force is contrasted with a six percent gain for Montana during the same period.

The past employment change by major industry groups is shown in Chart 10. As noted, Treasure County is a small but productive agricultural county. Like several Yellowstone Valley areas, its diversified irrigated farming plays an important role in creating jobs and income. Over one third of all job losses occurred in the agriculture industry group. A decline of about one fourth of the male labor force and a nine percent decline of the male population accounted for the decline in employment. Women increased their share of jobs by accounting for one fifth of all work positions in 1960. The unemployment ratio inched upward but remained at a minor level at the close of the decade.

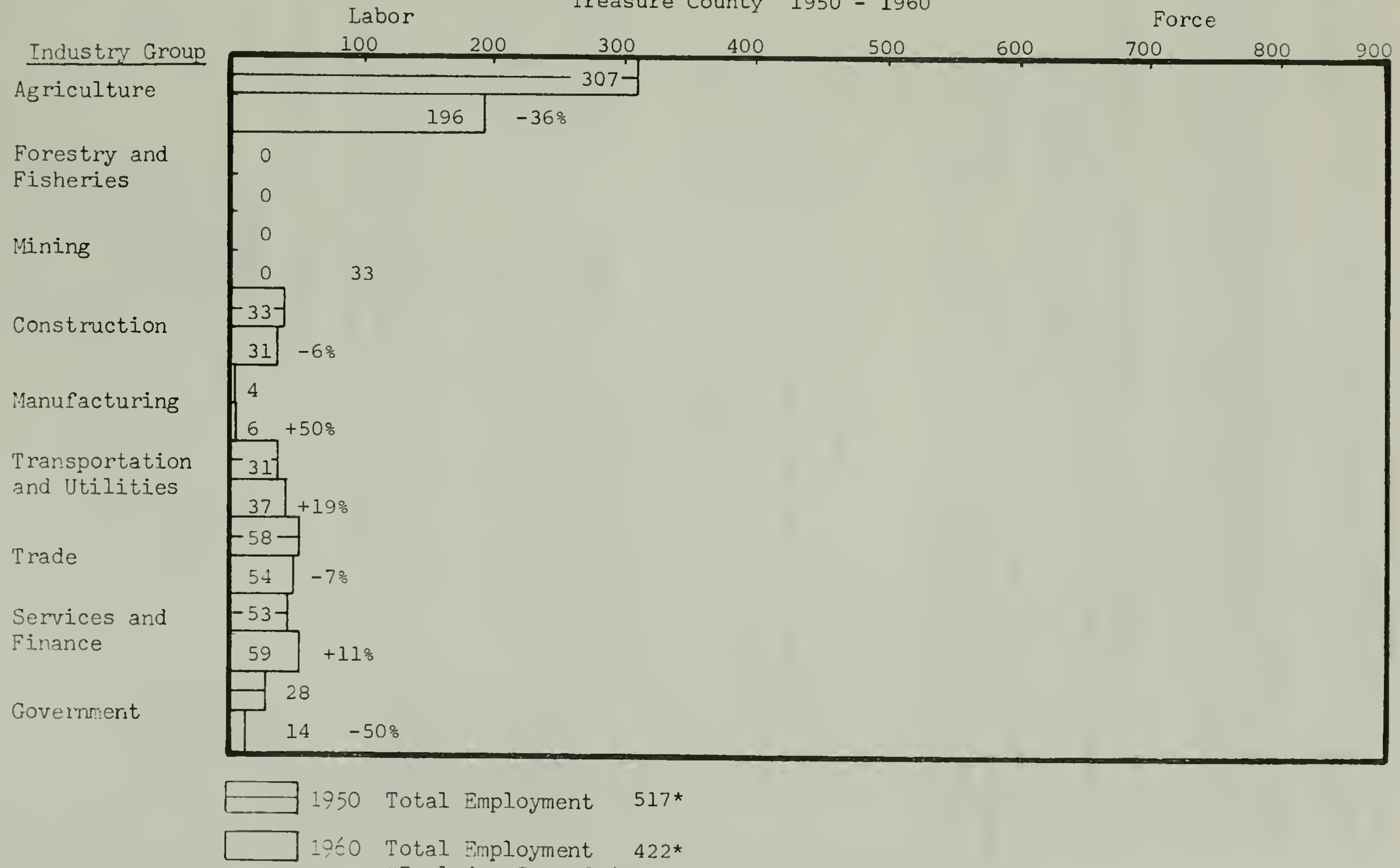
Only minimum goods and services are available in the county, and these are mainly in the town of Hysham. The county lies within the Billings primary and secondary market area and as a result does not provide any selection of goods and services on the local level. The reliance of the county on other areas for goods and services is further seen in an analysis of the composition of the services and finance and the trade industry groups.

In the first category, two thirds of all those represented were school teachers. There was also an obvious absence of representation from the professional services. In the trade group, over half of all employment was accounted for by restaurant and bar workers. Only one fourth of this labor group were in retail sales.

Percentages for employment by industry group in Table 4 provide an insight into local employment characteristics. The table shows the relative weight of each industry group in the county and offers a comparison with that existing in 1960 for the State of Montana and the United States.

CHART 10

Employment Change by Major Industry Group
Treasure County 1950 - 1960



*Includes Some Industries Not Reported

Source: U. S. Census of Population, 1950-1960

The agriculture industry group represented almost half of the total labor force in 1960. The county rate was almost three times that of the state and five times that recorded for the nation.

Similar to agricultural areas, most groups had employment rates below those in Montana and the United States. Exceptions are noted, however, for the construction and the transportation and utilities industrial groups.

Labor statistics are published on an annual basis by the Employment Security Commission of Montana. Data for 1969 indicates a continuing employment decrease in all reported industry groups. The decline is a result of the intensification of agriculture in the county.

Unless mineral resources are discovered, growth in the county will be moderate. Agriculture will continue as the major supplier of incomes and jobs. Livestock feeding could increase and thereby change the type of farming operations.

TABLE 4

Percent of Total Employment by Industry Groups

Treasure County, Montana and United States

1960

	Treasure County	Montana	United States
Agriculture	49	17	11
Forestry and Fisheries	0	1	1
Mining	0	3	1
Construction	8	7	5
Manufacturing	1	10	27
Transportation and Utilities	9	9	7
Trade	14	21	19
Service and Finance	15	26	16
Government	4	6	13
Total	100	100	100

Source: U. S. Census of Population, 1960

Agriculture

The United States Census describes a farm as a place having at least ten acres of land devoted to agriculture and selling at least fifty dollars worth of agricultural products annually. According to Chart 11, there were 129 farms in Treasure County in the above category in 1964, about seven percent fewer than there were in 1959.

The 1964 classification of farms by type was as follows:

Field crop farms other than vegetables, nuts, and fruit		31
Cash grain	4	
Other field crops	27	
Dairy farms		1
Livestock farms other than poultry and dairy		74
General farms		13
Miscellaneous and unclassified		10
Total		129

One farm in four was classified as a crop producer while over half primarily raised livestock. The average size farm in the county in 1964 was 4,993 acres. Chart 12 indicates that just over half of all farms were over one thousand acres while one third were under five hundred acres.

The value of products sold by the number of farms is shown in Chart 13. As indicated, almost two thirds of all farms reported agricultural sales exceeding $10,000. Thirty eight percent had receipts of more than $20,000 from the sale of agricultural products.

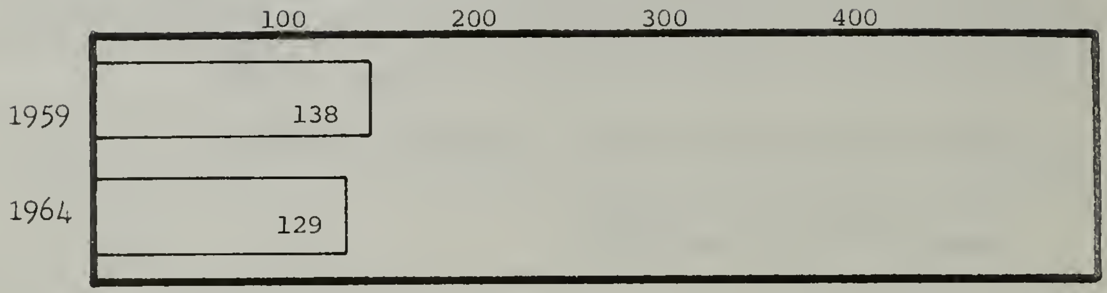
Cash receipts data from 1964 to 1967 is as follows:

Year	Livestock	Crops	Total
1964	$1,521,600	$1,710,600	$3,232,200
1965	$2,044,900	$1,312,500	$3,357,400
1966	$2,345,300	$1,492,400	$3,837,700
1967	$2,125,600	$1,524,500	$3,650,100

CHART 11

Number of Farms

Treasure County 1959 - 1964



Source: U. S. Census of Agriculture, 1964

In 1964 the sale of livestock products accounted for less than half of all agricultural products sold. Throughout the four year reporting period the ratio of livestock products to crop products increased, reflecting the added importance of cattle on the local agricultural economy.

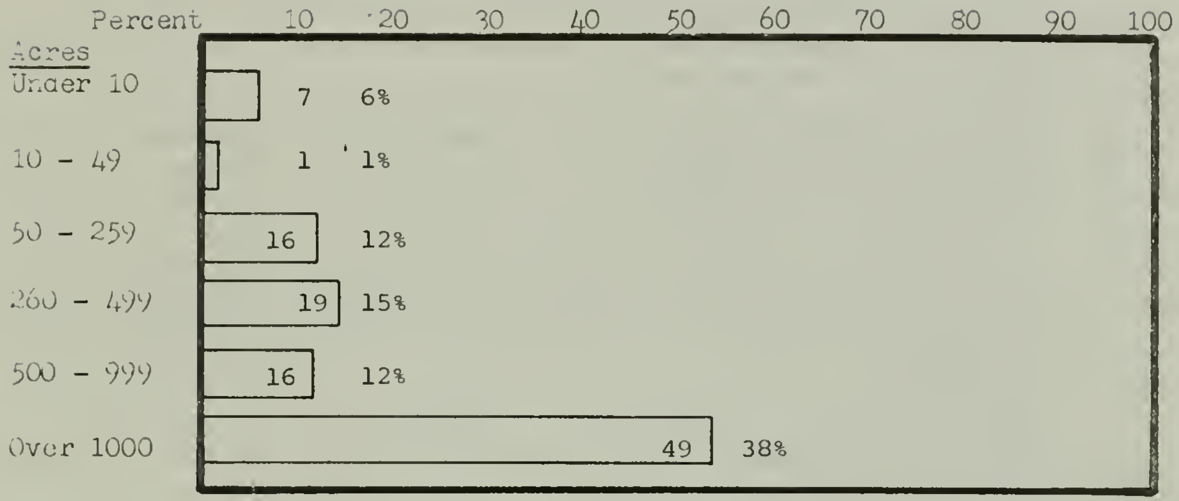
Throughout the planning period agriculture will remain the backbone of the local economy. The raising of livestock will increase while less emphasis is placed on crop products.

THE GOVERNMENT

Before any meaningful consideration can be given to major capital improvement projects, it is necessary to study the governmental

CHART 12

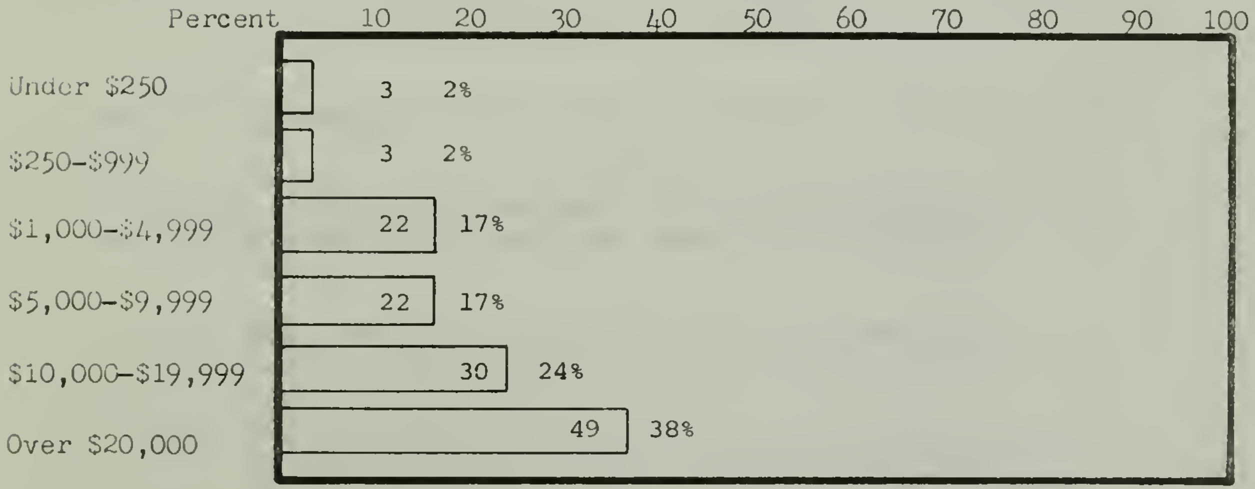
Farms by Size
Treasure County 1964



Source: U. S. Census of Agriculture, 1964

CHART 13

Number of Farms by Value of Farm Products Sold
Treasure County 1964



Source: U. S. Census of Agriculture, 1964

organizations in Treasure County and to analyze their economic structure. At present there are two separate, local governmental units in the county involved within the scope of this water and sewer study. Included are the incorporated city of Hysham and the government of Treasure County.

A Board of County Commissioners presided over by a chairman governs the county. The incorporated municipalities are governed by a mayor council form of government.

In financing capital improvement projects, the incorporated municipalities have power to bond and raise the necessary monies for funding projects. The unincorporated small towns do not have similar power and, therefore, must rely on financing projects through the county government.

Table 5 indicates the financial condition of each unit of government in 1969.

TABLE 5

Financial Status of County Government and Incorporated Cities
Treasure County 1969*

	Revenue	Expenditures	Assessed Valuation
Treasure County	$107,024.33	$111,567.77	$8,278,235.00
Hysham	61,011.00	63,137.68	1,096,223.00

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* There are several methods presently available to communities for financing water and sewer systems:

1. Incorporated Cities and Towns may use Municipal Bonds, Municipal Revenue Bonds, and Special Improvement District Bonds.

2. Unincorporated Towns may use Rural Special Improvement District Bonds and County Water and Sewer District Bonds.

3. Incorporated Cities and Towns and adjacent unincorporated areas may use Metropolitan Sewer District Bonds.

Source: Information received from each governmental unit

THE WATER RESOURCES

General

The water resources of any area are one of its most important assets. Montana is fortunate in that water is in abundant supply over much of the state. This is especially true in the mountain areas and along the major drainages. Water is essential for many human needs with individual consumption and sanitation being foremost. Industrial and agricultural uses of water are perhaps next most important. The recreational use of water has also become a significant factor in modern day living.

In his use of this resource, man in the past has polluted much of the available fresh water and degraded it to the point where it is unfit for many or all uses. Careful planning for the efficient use of water resources can avert inconveniences caused by pollution.

Water resources, therefore, are an important consideration in the comprehensive planning for community water and sewer systems. In the following portion of this report the existing water resources of the planning area will be briefly reviewed. The discussion will be specifically concerned with the occurrence and availability of both surface and ground water. Also important, and included in Appendix I, are the specific laws and policies of the State of Montana concerning surface and ground-water resources. "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" adopted by the State Department of Health are discussed in detail. Table A in Appendix I outlines present day water quality standards as set forth by the United States Health Service.

Surface-Water Resources

Treasure County has an extensive drainage system which has primary characteristics of plains topography. Drainage may be found flowing in almost any direction; however, the main drainage pattern is toward the Yellowstone River valley in central Treasure County.

Elevation differences are not excessive, and the complex surface drainage system is mainly attributed to the somewhat rugged hill and valley topography. In general, the highest elevations, over 3,700 feet, occur in southeast Treasure County and the lowest elevation, just over 2,500 feet above sea level, occurs where the Yellowstone River leaves the county east of Hysham.

The major drainage features are the Yellowstone and Big Horn Rivers.

The Yellowstone River enters Treasure County southwest of Hysham near Big Horn and flows approximately thirty miles northeast and east before entering Rosebud County east of Sanders. The Big Horn River forms the county line between Yellowstone and Treasure Counties southeast of Big Horn. The Big Horn River flows in a northerly direction to its confluence with the Yellowstone at Big Horn. The Yellowstone River is the eventual recipient of all drainage from Treasure County. The Yellowstone River flows northeast across eastern Montana before joining the Missouri River near the Montana-North Dakota line northeast of Sidney.

The above streams provide a yearlong source of water for irrigation, livestock, and domestic needs. These streams have had, at various times, gaging stations installed by the United States Geological Survey (U. S. G. S.) where flow measurements are taken and recorded at regular intervals. Table 6 includes available data on the drainage area, discharge, and runoff for the gaging stations on the Yellowstone River at Huntley in Yellowstone County and at Miles City below the Tongue River in Custer County. Also, the gaging station at Big Horn in Treasure County is included.

Many small reservoirs in Treasure County add significantly to the agricultural and especially the irrigational use of water in the county. As is the case in most counties in Montana, there are no records for small reservoirs published by the U. S. G. S. The Montana Water Resources Board, however, has published a list of information for those reservoirs, both publicly and privately owned, which store fifty acre feet or more of water. Also, the Water Resources Board has published a "Water Resources Survey" for Treasure County, Montana which includes a history of land and water use on irrigated areas and includes maps showing irrigated areas and designating sources of supply. This publication was issued in December, 1951. The above sources of information should be consulted for further details on the irrigation facilities and the use of surface water in Treasure County.

The climate does not have the extreme variable pattern common to the more mountainous western counties of Montana. Precipitation averages do vary across the county with the areas of highest elevation in the southeastern portion of the county reporting the highest precipitation averages. For example, a precipitation measuring station located at Hysham has recorded annual precipitation values of as much as 18.87 inches in 1927 to 5.66 inches in 1934. The average annual precipitation at Hysham is approximately twelve inches. Reflecting higher elevations, a precipitation measuring station located nineteen miles southeast of Hysham recorded a 1969 precipitation figure of 17.10 inches. This figure was an estimated value; however, climatological records indicate that this is a near average annual figure. It is

TABLE 6

Stream Gaging Stations

Stream	Gaging Sta. Location	Drainage Area (sq mi)	See Notes	Discharge (cfs)					Years Averaged	Runoff-(1000 Acre-Ft)			
				Max.	Date	Min.	Date	Average		Max.	Date	Min.	Date
1. Yellowstone River	At Huntley in Yellowstone County	12,000	1	60,000	6/20/16	1,060	12/27/07		*	6,400	1908	5,280	1910
2. Bighorn River	At Bighorn	22,885	1,2	26,200	6/24/47	275	11/15/59	3,739	23	4,006	1947	1,910	1960
3. Yellowstone River	At Miles City below Tongue River in Custer County	48,253	1,2	96,300	6/19/44	996	12/14/32	11/050	41	12,090	1943	4,229	1934

Source: U. S. Geological Survey Water Supply Papers and "Surface Water Records of Montana"

Notes:
1. Irrigation diversions occur above these stations
2. Flow is regulated by one or more reservoirs

* Not Recorded

important to note that the majority of the annual precipitation throughout Treasure County falls during the growing season of April through September.

In general, precipitation occurs as steady rains in the spring months of April through June, intermittent showers throughout the summer and early fall months, and as snowfall during the winter months. Snowfall is generally light, and does not tend to remain on the ground for long periods of time. Winter warming spells producing thawing temperatures throughout the county are not uncommon.

The use of surface water is widespread for agricultural and recreational purposes. Agricultural uses of water are important to the county. The 1964 Census of Agriculture reports 17,187 acres were being irrigated at that time. This denotes an increase over the 16,225 acres which were being irrigated during the previous census year of 1959. As is the case in most counties in eastern Montana, a potential exists for the irrigation of many additional acres. Also important is the use of surface water for recreational purposes. The ponds, reservoirs, and streams in the county are ideal habitat for fish and waterfowl and draw many sportsmen to the area each year.

Water Use Classifications

The Water Pollution Control Council has classified the streams and drainages in Montana according to the water use classification definitions shown in Appendix I. The streams and drainages of Treasure County and surrounding areas are classified as follows:

Yellowstone River Drainage from the Billings water supply intake to the North Dakota line except the tributaries pertinent to Treasure County listed below:	B-D_3
Pryor Creek Drainage	B-D_1
Big Horn drainage above but excluding William's Coulee near Hardin	B-D_1
Big Horn drainage from and including William's Coulee to the Yellowstone River except the Little Big Horn listed below:	B-D_2
Little Big Horn drainage above and including Lodge Grass Creek near Lodge Grass	B-D_1

Ground-Water Resources

As of January 1970, the Montana Bureau of Mines and Geology had on file 285 appropriations for wells and 122 appropriations for springs for Treasure County. A total of 205 wells were appropriated for livestock use, twenty four for domestic use, fifty four for both stock and domestic use, and two for public use. A total of fifty six springs were appropriated for stock use, one for domestic use, one for both stock and domestic use, and seven for irrigation; the uses for fifty seven springs were not reported. Hysham, the county seat of Treasure County, obtains water for municipal use from (a) the Yellowstone River, (b) an infiltration well, and (c) a well drilled near the Yellowstone. (See Table 7 for chemical analyses of these water supplies.) One technical report has been published that discusses the ground-water resources of Treasure County. The report is: Hall, G. M., and Howard, C. S., 1929, Ground water in Yellowstone and Treasure Counties, Montana: U. S. G. S. Water Supply Paper 599, 188 p.

The geologic history of Treasure County includes long periods of sedimentation, uplift, and erosion. Geologic formations of importance to the ground-water resources of Treasure County were deposited during Cretaceous time (65 to 135 million years ago), through Tertiary time (one to 65 million years ago), to Quaternary time (less than one million years ago--includes Pleistocene, twenty thousand to one million years ago, and Recent, less than twenty thousand years ago). Uplift at the close of Cretaceous time and during the beginning of Tertiary time and subsequent erosion caused older formations to be exposed at the ground surface in northern Treasure County than those exposed in the southern past of the county. Continental glaciation during the Pleistocene epoch did not reach as far south as Treasure County. Ground-water resources of Treasure County are greatly influenced by geological conditions. The geological units of importance are as follows: alluvium and river terrace deposits of Recent and Pleistocene age; Fort Union Formation of Early Tertiary age; and the Hell Creek, Fox Hills, Bearpaw, Judith River, Claggett, and Eagle Formations of Cretaceous age. There are older geologic formations that will yield water to wells, but these are too deep lying to be of importance to the county's ground-water resources.

Alluvium of Recent age is found in flood plains of the Yellowstone River, Big Horn River, Tullock Creek, and in some smaller streams. The alluvium is reported to have a maximum thickness of about one hundred feet and consists of mixtures of clay, silt, sand, and gravel deposited by streams. The alluvium in Treasure County is generally a fair aquifer (water yielding material) and supplies water to many shallow dug wells. Wells drilled into alluvium along smaller streams and tributaries often produce poor quality water in amounts adequate only for stock or domestic use. However, small to moderate supplies of fair quality water for both stock and domestic use are obtained from wells drilled into thicker layers of alluvium along the major streams.

TABLE 7

Chemical Analysis of Municipal Water Supplies
(All Figures in Milligrams per Liter)*

City or Town	Hysham	Hysham	Hysham
Source	Yellowstone River	Infiltration Well	Well by River
Date	6/66	1/59	1/59
Total Solids	420	677	660
Hardness	198	344	365
Ca	53	85	90
Mg	16	32	34
Na+K	83	94	90
CO_3	0	0	0
HCO_3	250	238	256
SO_4	152	317	313
Cl	10	14	15
NO_3	0.0	1.2	1.1
F	0.6	0.4	0.4
Fe	0.24	0.2	0.2
As	-	0.0	0.0
Pb	-	0.0	0.0
Cu	-	0.0	0.0
Zn	-	-	-

* See Appendix I, Table A, for accepted water quality standards

Source: State department of Health, Helena, Montana

Older river deposits have created a low terrace along the south side of the Yellowstone River in the vicinity of Hysham. Where there are sufficient thick and saturated zones of gravel and sand, abundant supplies of fair to good quality water can be obtained from wells. Maximum thickness of the terrace gravels is estimated to be fifty feet.

The Fort Union Formation of Early Tertiary age is exposed at the ground surface over much of the southern half of the county. The total thickness of Fort Union sediments consists of about 2,400 feet of clay, shale, lignite coal, sandy shale, and massive resistant yellow to buff sandstone. The full thickness of the Fort Union is not present in Treasure County. The Fort Union is divisible into three units, the Tullock Member (lower), the Lebo Member (middle), and the Tongue River Member (upper, or youngest). The Tongue River Member is a good aquifer where it is not dissected by streams and drained. Ground water of fair quality is obtained from numerous sandstone beds. The Tongue River Member is exposed at the ground surface in southeastern Treasure County. The Lebo Member consists of two hundred to three hundred feet of dark, olive green to brown sandy shale and thin bedded arkosic sandstone with beds of carbonaceous sandstone and coal. Generally, little if any potable water can be obtained from the Lebo Member. The Tullock Member consists of about 375 feet of yellow to yellow gray shale with numerous beds of yellow or brown sandstone and lignite coal. The Tullock will usually yield adequate amounts of fair quality water to wells for stock and domestic use.

The Hell Creek Formation, Cretaceous in age, underlies the Fort Union Formation. The Hell Creek is exposed at the ground surface in central Treasure County and in a broad band along the western border of the county. The Hell Creek consists of about eleven hundred feet of light greenish to yellow shale with thick beds of sandstone and practically no coal. Sandstone units generally supply small to moderate amounts of fair to good quality water to wells for stock and domestic use.

The Fox Hills Formation, underlying the Hell Creek, has not been separately mapped in Treasure County and is included with the Hell Creek. The Fox Hills generally consists of an upper massive sandstone member and a lower member having a composition similar to the Hell Creek. Where the upper member is not present, the lower member is usually included with the Hell Creek Formation. The Fox Hills, which farther west is equivalent to the Lennep Sandstone, will generally yield small to moderate quantities of fair quality water to wells.

Beneath the Fox Hills Formation lies the Bearpaw Formation. The Bearpaw consists of about one thousand feet of dark, dense, bentonitic shale that is generally non water bearing. Wells drilled into the Bearpaw generally produce no water or small amounts of very poor quality water. The Bearpaw is exposed at the ground surface over much of northern Treasure County.

The Judith River Formation underlies the Bearpaw Shale. The Judith River is exposed at the ground surface over a very small area near the east end of the northern border of the county. The Judith River consists of about four hundred feet of sandstone and shale beds. Only one well located in Sec. 15, T.7N., R.36E., in Treasure County is reported to be producing water from the Judith River Formation. The well is 740 feet in depth and has an artesian flow. The Judith River is capable of producing adequate supplies of fair to good quality water for stock and domestic use.

The Claggett Formation, which underlies the Judith River, consists of about six hundred feet of dark gray shale. In some places the Claggett contains sandstone layers. The Claggett is generally non water bearing, and if water is encountered it is usually too highly mineralized for household use.

Beneath the Claggett is the Eagle Formation. The Eagle is chiefly a sandstone, but does contain some shale near the middle of the formation. The Eagle is approximately three hundred feet thick. Wells drilled into the Eagle will only yield a small supply of water that is often hard but adequate for domestic use.

More than two thousand feet of shales and shaly sandstones (the Colorado Formation) that produce little potable water lie below the Eagle and in turn are underlain by a thick sequence of sedimentary rocks. These deep-lying geologic strata below the Eagle are not important to the ground-water resources of Treasure County.

Development of the ground-water resources in Treasure County will probably continue at its present low rate. There is little opportunity in the county for development of large, high capacity wells for irrigation or industry. Future ground-water development in the county would be assisted by additional detailed hydrogeological studies.

Sources:
1. M. K. Botz, Montana Bureau of Mines and Geology, Butte, Montana, 1970
2. State Department of Health, Helena, Montana
3. U. S. G. S. Water Supply Papers and "Surface Water Records of Montana"
4. "Water Resources Survey," Treasure County, Montana, Montana Water Resources Board, 1951

5. Weather Bureau, Climatological Data
Montana Section, 1969

THE SOILS

General

General descriptions of soils in specific areas are useful in predicting the potential problems which might be encountered during private and public works construction. Treasure County has an interesting and complicated geologic history which has greatly influenced the soil structure of the area. Physiographically, Treasure County is an upland plains area consisting primarily of rolling hills broken by deeply entrenched streams. A dominate physiographic feature of Treasure County is the broad Yellowstone River valley through the central portion of the county.

The present land forms of the county are results of long periods of erosion by the forces of both wind and water. Parent materials consisting primarily of sedimentary rocks have been eroded, transported, and deposited by various processes. Extensive drainage throughout the area over periods of time has resulted in the filling of many stream valleys and drainage basins with alluvium. Also, many of the land forms in Treasure County consist of terraces and benches which are remnants of ancient drainage patterns. The soils of Treasure County are made up of the alterations of alluvium and other parent materials of the hills and plains due to conditions of climate, topography, and living organisms.

Soil Map

The Soil Conservation Service of the United States Department of Agriculture in cooperation with the Montana Agricultural Experiment Station has prepared a publication entitled "Soil Survey of Treasure County, Montana," which was issued in February, 1967. As part of this survey, a general soil map was prepared, and it is reproduced in this report as Map 4. In developing this map, the Soil Conservation Service made field studies and observations which resulted in the designation of ten soil associations. Each general soil association, as a rule, contains a few major soils and several minor soils. Soils within an association may differ greatly in short distances and any one soil may occur in more than one association. Thus, the general soil map does not show the kind of soil at any particular point but shows specific patterns of soils.

Much valuable information which is very pertinent to the planning and construction of public works projects is contained in the published report of this soils survey. Detailed descriptions of soils within each association and detailed large scale maps of the entire study area are included in the report. Also included is a section entitled "Engineering Properties of Soils" which deals with specific physical and chemical properties of the soils and the interpretation of these properties in relation to such engineering uses of soil as road construction, foundations for structures, drainage, and disposal of sewage. It is recommended that this publication be consulted during the planning for any public works project in Treasure County. Also, the services of the Soil Conservation Service soil scientists should be utilized for interpretation of soil properties in specific areas. In addition, on site soil investigations should be performed.

In general, the soils of Treasure County range from very poor to very good as far as engineering related uses are concerned. The following brief descriptions of the soil associations shown on Map 4 indicate the wide variety of soils which can be expected to be encountered in Treasure County.

Soils of Irrigated Bottom Lands and Terraces.

1. Havre-Lohmiller-Glendive Association. These are deep, light colored loams, clay loams, and sandy loams on bottom lands and fans along the Big Horn and Yellowstone Rivers.

2. Nunn-Fort Collins-Cherry Association. These are deep, well drained loams, clay loams, and clays on Hysham Bench and adjacent fans.

Soils of High Terraces.

3. Gilt Edge-Arvada Association. These are deep, well drained soils with a claypan on nearly level high terraces of the Yellowstone River.

4. Wanetta-Hesper Association. These are deep and moderately deep, loam soils on nearly level to sloping high gravel terraces of the Yellowstone River.

Soils of Rolling to Rough, Broken Uplands on Soft Shale.

5. Flasher-Bainville Association. These are moderately deep, dark colored, sandy soils and moderately deep to shallow, light colored, loamy soils on strongly rolling to hilly uplands in the southern part of the county.

6. Bainville-Midway Association. These are moderately deep to shallow light colored loams and clay loams on rolling to rough, broken uplands.

7. Bainville-Cushman-Tullock Association. These are shallow to moderately deep loams and sandy loams on undulating to strongly rolling uplands north of the Yellowstone River.

8. Terry-Treasure-Tullock Association. These are deep and moderately deep, sandy soils on undulating or rolling uplands.

Soils of Rolling to Hilly Uplands on Clay Shale.

9. Marias-Pierre-Hoven Association. These are deep and moderately deep saline-alkali and saline clays on fans, terraces, and uplands north of the Yellowstone River.

10. Pierre-Lismas Association. These are moderately deep and shallow granular clays on shale uplands south of the Yellowstone River.

Conclusions

The soils of Treasure County have generally been easy to deal with where shallow domestic water wells and individual sewage drainfields have been constructed. The large amounts of alluvium and other surface deposits have been found to be extremely variable in permeability, however. This has had an effect on both the quantity of water available in shallow domestic wells and the successful operation of individual sewage drainfields. Some areas of extensive clay and silt deposits require special care in the construction and operation of septic tank drainfields.

Construction of municipal water and sewer systems in the various soils of Treasure County has not been found to be difficult. Pipeline trench digging in the sands and clays is extremely easy while the coarse materials such as stream gravels slow operations somewhat. Bedrock at shallow depths is not common in valley bottoms; however, it can be expected at normal water and sewer line installation depths on the uplands adjacent to stream drainages. Detailed soil information should be obtained before project planning and construction cost estimating are begun.

Source: "Soil Survey of Treasure County, Montana," U. S. Department of Agriculture, Series 1957, No. 22, February, 1967

COMMUNITY WATER SYSTEM FACILITIES

General

This comprehensive report covers the overall problems, existing or projected, for Treasure County, Montana. The volume of data processed and evaluated and the intent of the report allow only a general analysis of any one system.

The intent of this report is to point out the general needs of each community with the objective that each community may in the future be provided with a safe and adequate water system. The general solutions to overall problems suggested in this report may have to be modified when detailed studies are made. These modifications may be in exact size of parts of a system or in some detailed design variation but will not detract from the overall value of the general information presented.

Basically, the demand for water from community systems is for domestic, fire fighting, and industrial use. The demand for industrial water supply in small communities has not been extensive in Montana and in most cases will not control the design of community systems. Sufficient water for fire fighting must be considered; however, economic feasibility will usually control the extent of such facilities. In most small communities a system with sufficient capacity to give high ratings for fire protection would require facilities considerably larger than necessary for domestic purposes. The community might be unable to finance such an improvement; the approach, therefore, has been to propose a system suitable for present domestic needs. These basic facilities can be expanded for more complete service and for higher fire ratings as it becomes economically feasible.

The domestic use of water has increased greatly in recent years. This is partially due to improved economic conditions which make it possible for families to acquire such water consuming appliances as dishwashers, waste disposal units, and automatic washing machines. Water use for beautifying property has also increased. The most essential condition is adequate, safe, and potable water for domestic purposes, and this has been the primary consideration in this study. See Appendix II for further comments on analysis criteria.

Basic Considerations

Communities studied in this comprehensive plan were those with a minimum of five potential users and a maximum population of 5,500.

Each community within this category was visited at least once. During these visits the type of water facilities available was examined, and an evaluation of the facilities was made from the standpoint of fulfilling the needs of the residents.

The existing systems were found to be quite varied in their operation, condition, and suitability for serving the needs of the users. The situation in each community was evaluated separately; however, some general classification of the various systems was possible. These are described briefly in the following paragraphs so that the general philosophy of the analysis can be shown.

1. In some communities the homes are quite widespread and few in number. Good water in adequate quantities can be found at reasonable depths, and for such situations, private wells will provide a safe and suitable water system.

2. Many communities have had access to good water from private wells for many years. In some of these communities population is increasing, and the area is becoming more densely settled. As a result, tests for bacteriological quality of well water occasionally indicate that pollution is present. When this occurs, it is usually the beginning of a problem which will continue to worsen. Increasing population and a higher potential for contamination indicate the need for a safe community water facility. The system should be one which will serve the domestic needs of the present residents with provisions for improvements and expansion as needed.

3. Many communities have enjoyed a central water system for years but have not made annual improvements and replacements. This has resulted in overloaded and antiquated systems. Suggestions for immediate improvements which will fit into an overall replacement program are included in this report.

4. Some communities which have experienced a steady population growth are finding that their water systems are inadequate for present demands and will require enlargement. Population projections and economic trends are used to determine the need for improvements and also to justify the type and extent of proposed improvements.

Treasure County

The estimated 1970 population of Treasure County is one thousand. Approximately 450, or forty five percent of these people, are presently served by central water systems, and the remainder are served by such facilities as wells and springs. By 1990 about four hundred, or forty five percent of the population, will have access to central water systems if the schedule of proposed improvements is followed. It is expected that the remaining fifty five percent will live in outlying areas, and the homes will not be close enough together to make central systems feasible.

Hysham

Existing System. The estimated 1970 population is 450. Population projections indicate that the community will show decreased population through 1990. A community water system is in existence as shown on Map 5.

Water supply is obtained from an infiltration gallery at the Yellowstone River north of town. Two pumps are located at this point and have a combined pumping capacity of 210 gallons per minute (gpm). This is an adequate amount of water for the present and future populations of the town. A six inch supply line continues on to the distribution system. The distribution system consists of four and six inch diameter mains. This distribution system and supply line have adequate capacity for the present and future needs of the town and adequate flows and pressures are available throughout the system. The distribution piping consists of cast iron and asbestos cement lines. There is an electrolysis problem present in the community, and it has been necessary to replace many of the older lines. This is being conducted on an as needed basis with the eventual intent that all lines will be replaced. An elevated storage tank with a capacity of 100,000 gallons is located on the system. This is an adequate amount of storage for present and future needs.

Improvements by 1990. For 1990 the population is expected to be 375. Minor repair and replacement will be necessary for the existing water system. It is expected that all of the older cast iron lines will be replaced by this time. The system will then be adequate for the needs throughout the entire planning period. Continual maintenance will be necessary to keep the system in satisfactory operating condition.

COMMUNITY SEWER SYSTEM FACILITIES

General

Each use of water adds some material or alters some characteristic enough to change the original quality of the water and often to pollute it. The transportation and dilution of municipal, industrial, and agricultural wastes are important and necessary uses of water;

therefore, special emphasis is placed on the control of water pollution from these sources. Some of these wastes can be carried in limited amounts without damage to the resource. Some wastes if discharged into water courses can make their way into underground aquifers and pollute the ground water so that it is unsuitable for further use.

Pollution by definition and interpretation is a matter of degree. Since it is inevitable that the quality of water will be altered with each use, it is of critical importance to control the degree of pollution.

It is public policy established by the state legislature to maintain reasonable standards of purity for the water of the state. These standards are to be consistent with the use of these waters, including their use in carrying away the water borne waste products of society. The current Federal Water Pollution Control Act in reference to pollution abatement gives the individual states discretion in assessing the physical and economic feasibility of complying with water quality standards. The "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" of the Montana Water Pollution Control Council for streams and rivers in Montana have been included in Appendix I.

Sewage may be broadly categorized as domestic or municipal waste, industrial waste, and animal or agricultural waste. Animal wastes are usually not involved in community sewage facilities; however, they do constitute a potential source of pollution which must be controlled and prevented from entering streams or other potential water supplies.

Although industrial activity throughout Montana has been limited, the need for control and treatment of industrial wastes is apparent. Industrial wastes vary in quantity and composition as greatly as the products and processes which generate them. They include toxic chemicals, solids carried in suspension, brines, strong acids and alkalies, oils, dyes, floating solids, and the heat generated by industrial processes. Industrial wastes are not found to be a major factor in the design of most community sewage facilities. Where economic projections indicate industrial development, the relationship to loading on domestic sewer systems is considered.

Domestic sewage is the primary consideration of this study and has been the basis for design and analysis. Where particular systems are subjected to loading from industrial sources, a more detailed study will be necessary. The general approaches outlined in "Analysis Criteria" in Appendix III will suffice in practically all cases.

Basic Considerations

There are generally three main methods of sewage disposal. These are septic tanks, mechanical sewage treatment plants, and wastewater stabilization ponds. Local soil conditions, availability of land, and density of population are the basic factors which govern the selection of a particular method.

Many of the smaller communities have relied on individual septic tanks and cesspools for each home to handle sewage disposal. Septic tanks are suitable if the population density is low and if the systems are properly designed and maintained. Overflow from these tanks must drain into the soil and, depending on local soil conditions, may or may not create a problem. There is a limit to the amount of water than even loose granular soil can absorb. Density of population and the length of time the effluent has been entering the soil are factors which indicate whether septic tanks can be suitable for sewage disposal.

When economically feasible, community sewage collection and disposal systems are much more desirable than individual systems. Community systems eliminate the worry of septic tank failure, the danger of well contamination, and the problem of soil saturation. However, it is usually uneconomical to serve a few homes scattered over a large area with a community sewer system.

The type of sewage disposal facilities to be used can generally be determined on the basis of economic factors. Mechanical treatment plants provide an excellent means of sewage disposal although the initial cost, maintenance cost, and power cost are usually high. Wastewater stabilization ponds are an ideal method of sewage disposal and usually are the most economical to construct and maintain.

The Montana Water Pollution Control Council has established the criteria that treatment of domestic and industrial wastes shall be secondary treatment or its equivalent. For domestic sewage, mechanical treatment plants or stabilization ponds, when either is properly designed, constructed, and operated, meet these requirements.

A schedule for completion of secondary treatment facilities by communities across the state has been established by the State Department of Health. The target date is included for individual towns when applicable.

Treasure County

Approximately 450, or forty five percent of the Treasure County population, are presently served by community sewage facilities. By 1990 about 375, or thirty seven percent of the population, will have access to community facilities if the proposed expansion program is followed. The remaining sixty three percent will live in outlying areas, and the homes will not be close enough together to make community systems feasible.

Hysham

Existing System. The 1970 population is estimated to be 450. A community sewer system is in existence, and the layout is shown on Map 6.

The collection system consists of eight, ten, and twelve inch sewer mains. This system picks up sewage from each household and carries it to a collection point near the west edge of town. The system has adequate capacity for present and future needs of the town. A lift station is located west of town and is necessary to force sewage through a six inch force main to the treatment facilities. This lift station and force main have adequate capacity for present and future sewage flows. A 6.5 acre wastewater stabilization pond is used for sewage disposal. This facility has adequate capacity for the present and future anticipated populations of the town.

Improvements by 1990. For 1990 the population is expected to decline to 375. The existing sewer system will be adequate for the needs throughout the entire planning period. Minor repair, maintenance, and replacement will be the only improvements necessary to keep the system in satisfactory operating condition.

PREFACE TO MAPS

The following maps have been prepared from several sources. The county maps were prepared from Transverse Mercator Projection Series Maps and Montana Highway Department Maps, Planning and Survey Series. The reduction of the county maps necessary for this publication makes them useful for general reference purposes only.

The town and community base maps used herein are taken from Montana State Highway Commission City and Town Plats prepared from aerial photographs dated 1961 to 1969 and have been updated where necessary. On-site surveys, plats obtained from individual towns, and aerial photography conducted in 1970 were also used. Uncontrolled mosaics have been used and scales are, accordingly, only approximate and are shown for referencing purposes only. The mapping operation was supplemented by field checks made during 1970.

Land use information was obtained by field surveys, supplemented and checked by aerial photography during 1969 and 1970.

Water and sewer systems maps show existing facilities for individual towns and communities except where the information was not available. Data concerning these community facilities was obtained from the records of the individual communities and of the State Department of Health. Water and sewer lines are shown in the center of streets to indicate the existence of lines rather than precise locations. The sizes of lines, obtained from the most current information available, are indicated when possible. The locations of recommended improvements are given as relative locations and are not meant to be scaled from the individual town or community maps.

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TREASURE COUNTY LAND OWNERSHIP	3
TREASURE COUNTY SOILS	4
HYSHAM WATER SYSTEM	5
HYSHAM SEWER SYSTEM	6

MAP I

COUNTY MAP
GENERAL RELIEF

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

—— ROADS-HIGHWAYS
STATE HIGHWAY U. S. HIGHWAY

– – – – RAILROADS

STREAMS-LAKES

—·—·—· COUNTY BOUNDARY

INDIAN RESERVATION

□ 0-3,000 FT. ELEVATION

░ 3-5,000 FT. ELEVATION

▒ 5-7,000 FT. ELEVATION

▓ OVER 7,000 FT. ELEVATION

MAP 2

LEGEND

MAJOR STATE-WIDE COVERAGE

POWER AND GAS SYSTEMS

☐ POWER PLANT (IN MEGAWATTS)
---- 1 to 50 KILOVOLTS
—— 51 to 100 KILOVOLTS
-··-·- 101+ KILOVOLTS
·········· PROPOSED LINES
-•-•- GAS LINES

RECREATION AREAS

1. LOST CREEK STATE PARK
2. LEWIS AND CLARK CAVERNS STATE PARK
3. LAKE MARY RONAN STATE PARK
4. MEDICINE ROCKS STATE PARK
5. ROSEBUD STATE PARK
6. ROCK CREEK STATE PARK
7. MAKOSHIKA STATE PARK
8. WEST SHORE STATE PARK
9. WOODS BAY STATE PARK
10. BITTERROOT LAKE STATE PARK
11. ASHLEY LAKE STATE PARK
12. LONE PINE STATE PARK
13. JAMES KIPP STATE PARK
14. HOOPER MEMORIAL STATE PARK
15. HELL CREEK STATE PARK
16. FINLEY POINT STATE PARK
17. ELMO STATE PARK
18. FLATHEAD LAKE STATE PARK
19. YELLOW BAY STATE PARK
20. WALSTAD MEMORIAL PARK
21. THOMPSON FALLS STATE PARK
22. WHITEFISH LAKE STATE PARK
23. WAYFARERS RECREATION AREA
24. TIBER RESERVOIR RECREATION AREA
25. CLARK CANYON RESERVOIR RECREATION AREA
26. ENNIS RECREATION AREA
27. DEADMAN'S BASIN RESERVOIR RECREATION AREA
28. PAINTED ROCKS RESERVOIR RECREATION AREA
29. CANYON FERRY RECREATION AREA
30. LOGAN PARK RECREATION AREA
31. NELSON RESERVOIR RECREATION AREA
32. BEAVERTAIL HILL RECREATION AREA
33. GLACIER NATIONAL PARK
34. YELLOWSTONE NATIONAL PARK

▨ NATIONAL FORESTS

MAP 3

COUNTY MAP
LAND OWNERSHIP

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

—— ROADS-HIGHWAYS
STATE HIGHWAY U. S. HIGHWAY

— — — RAILROADS

〰 STREAMS-LAKES

—·—·—· COUNTY BOUNDARY

▒ INDIAN RESERVATION

▭ PRIVATELY OWNED LAND

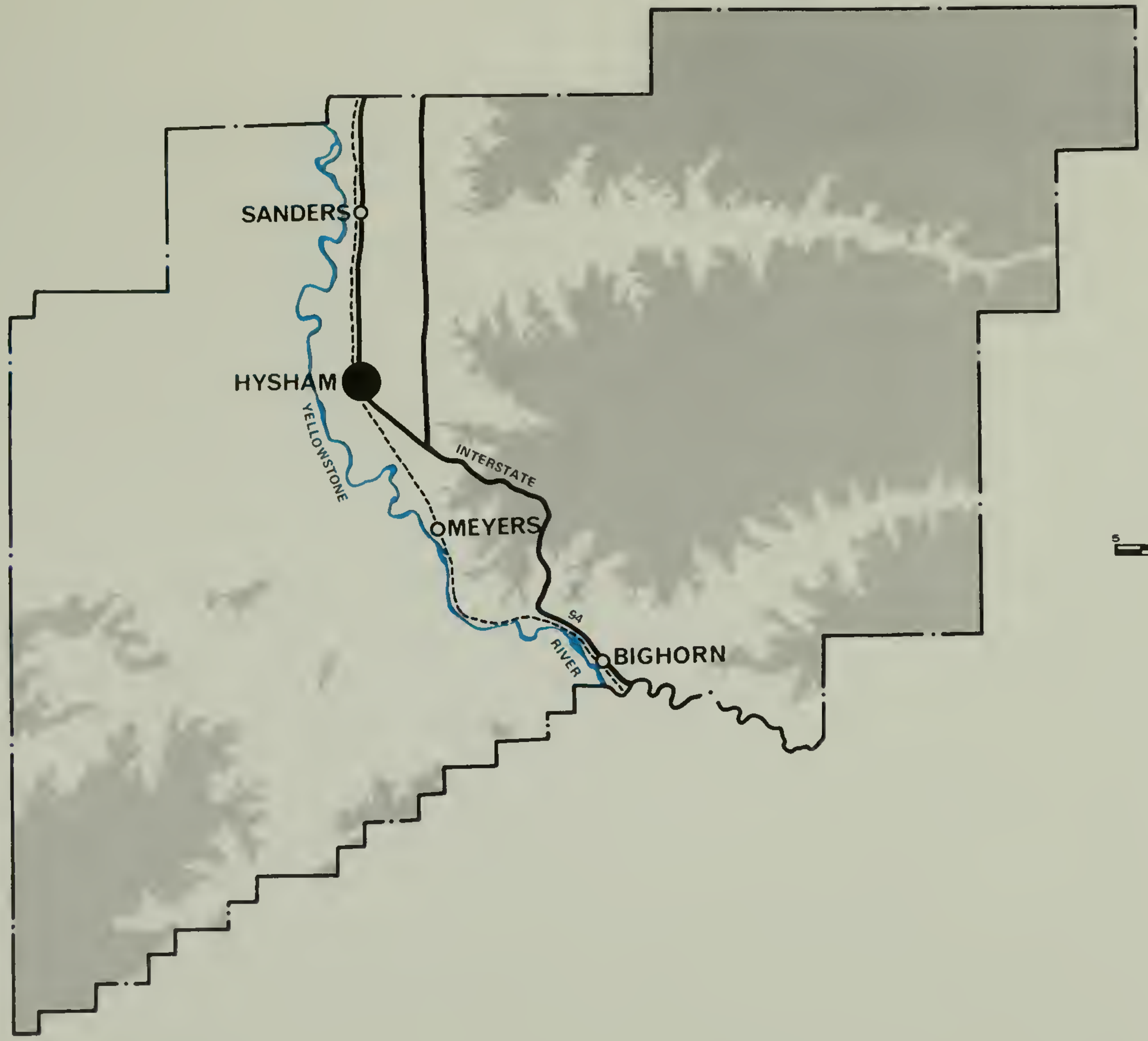
▬ STATE OWNED LAND

▨ FEDERAL OWNED LAND

CITIES MAP LEGEND

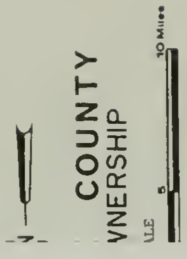
	LAND USE
●	SINGLE RESIDENCE
◒	DILAPIDATED RESIDENCE
Ⓣ	SINGLE TRAILER RESIDENCE
⊕	MULTIPLE RESIDENCE
○	APARTMENTS
⊤	TRAILER COURT
■	COMMERCIAL BUILDING
◩	HOTEL-MOTEL
△	PUBLIC BUILDING
Ⓢ	SCHOOL
⬢	CHURCH
⊞	HOSPITAL
✸	INDUSTRIAL
🄴	GRAIN ELEVATOR

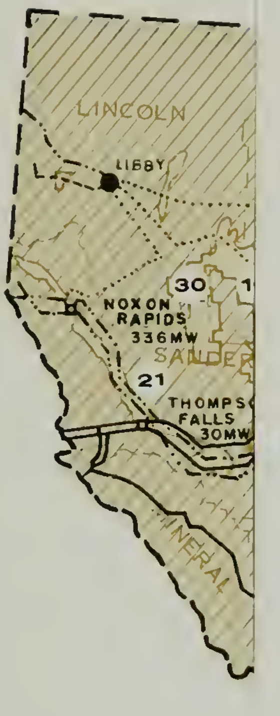
	WATER and SEWER SYSTEMS
—6—	EXISTING LINES AND SIZES
- - - -	PROPOSED LINES 5-10 YEAR
┈┈┈	PROPOSED LINES 10-20 YEAR
—◀—	EXISTING LIFT STATION
- -◁- -	PROPOSED LIFT STATION
⬤	EXISTING WATER STORAGE TANK
¤	PROPOSED WATER STORAGE TANK
—▣	EXISTING WATER SOURCE
- -▣	PROPOSED WATER SOURCE
—□	EXISTING TREATMENT FACILITIES
- -□	PROPOSED TREATMENT FACILITIES
▧	SERVICE AREA 1970-1980
▩	SERVICE AREA BY 1990



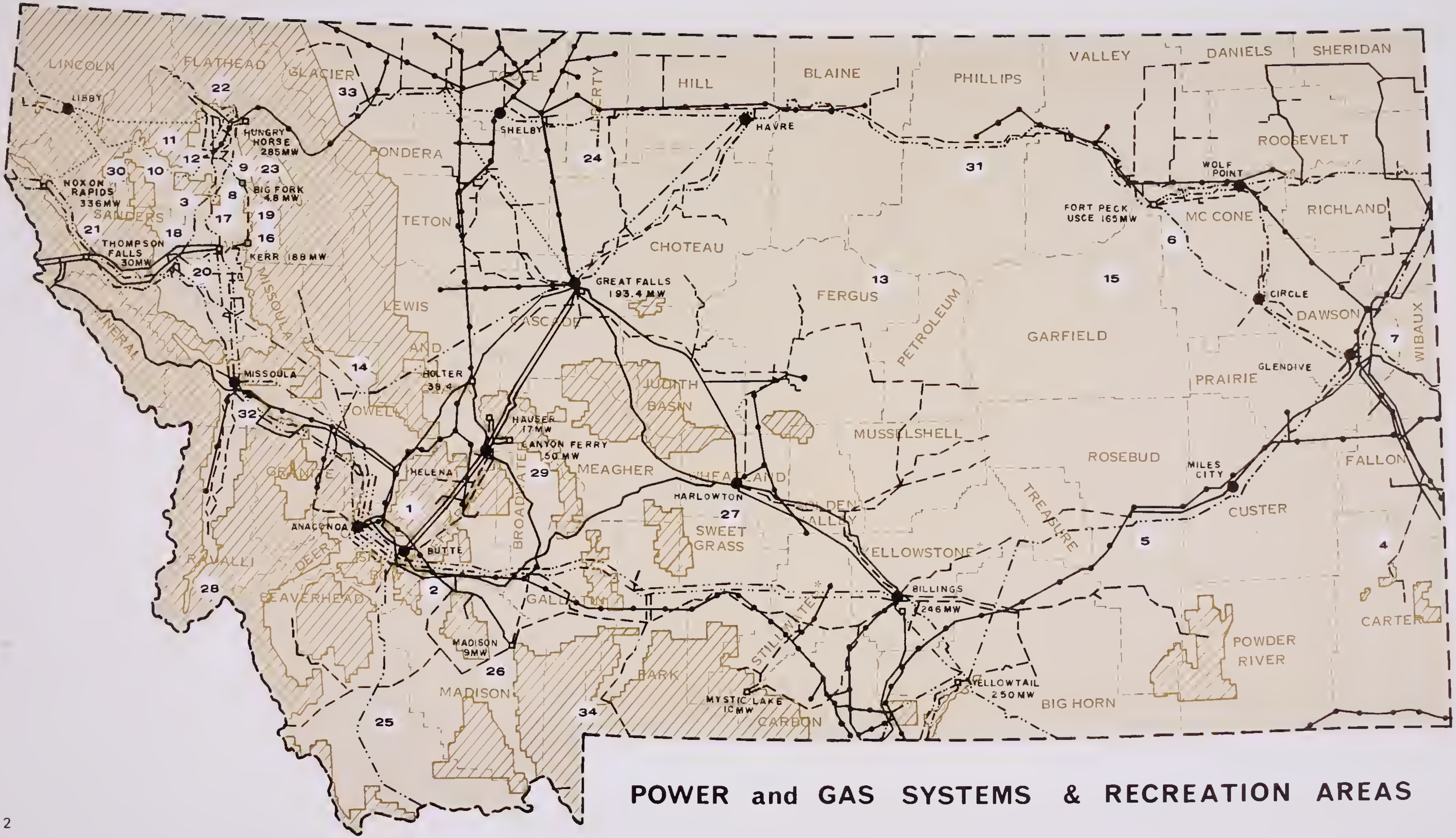
TREASURE COUNTY
TOPOGRAPHY

MAP 1


COUNTY
VNERSHIP
ALE 5 10 Miles
P 3

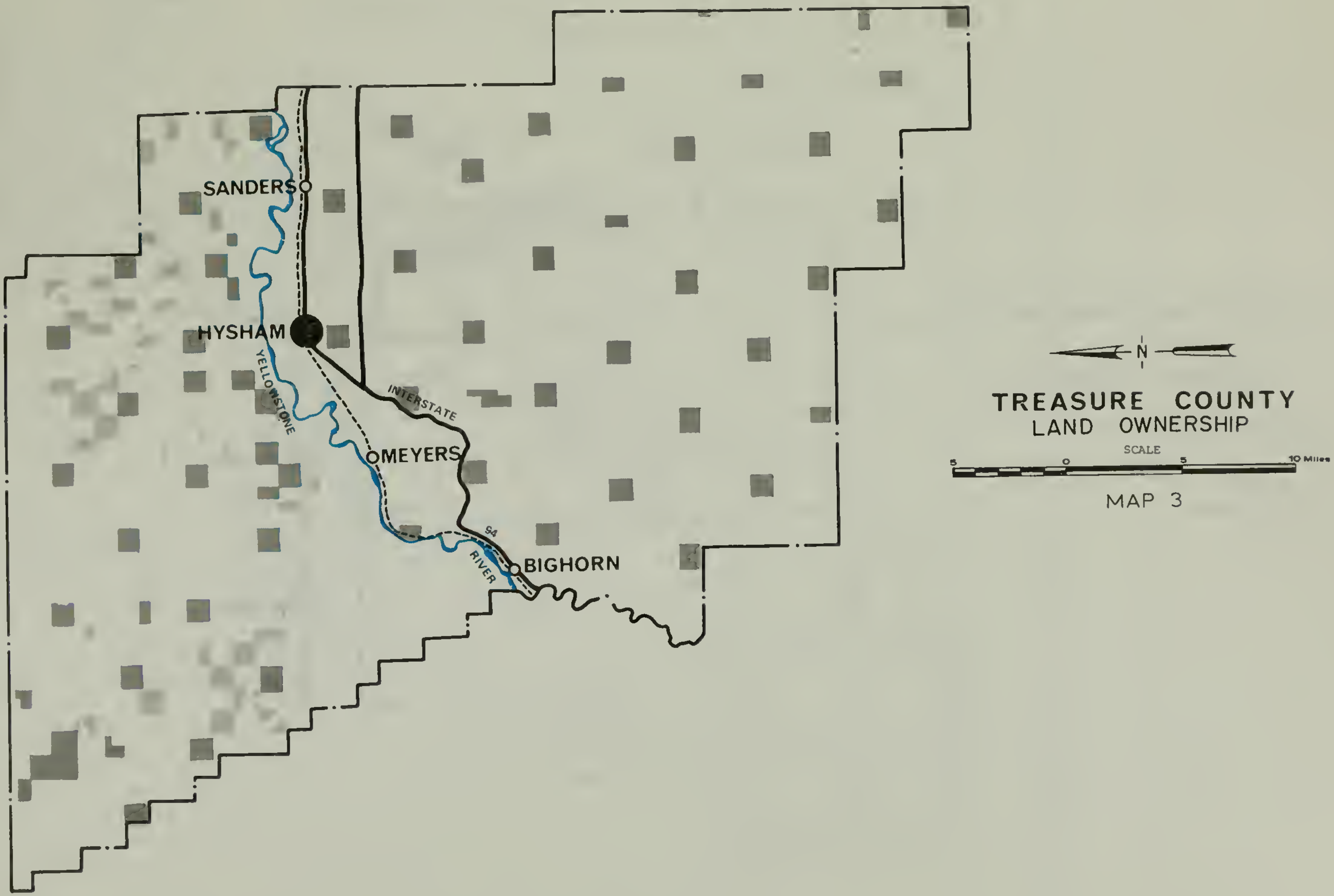

LINCOLN
LIBBY
30
1
NOXON RAPIDS 336MW
SANDER
21
THOMPS FALLS 30MW
NERAL

MAP 2



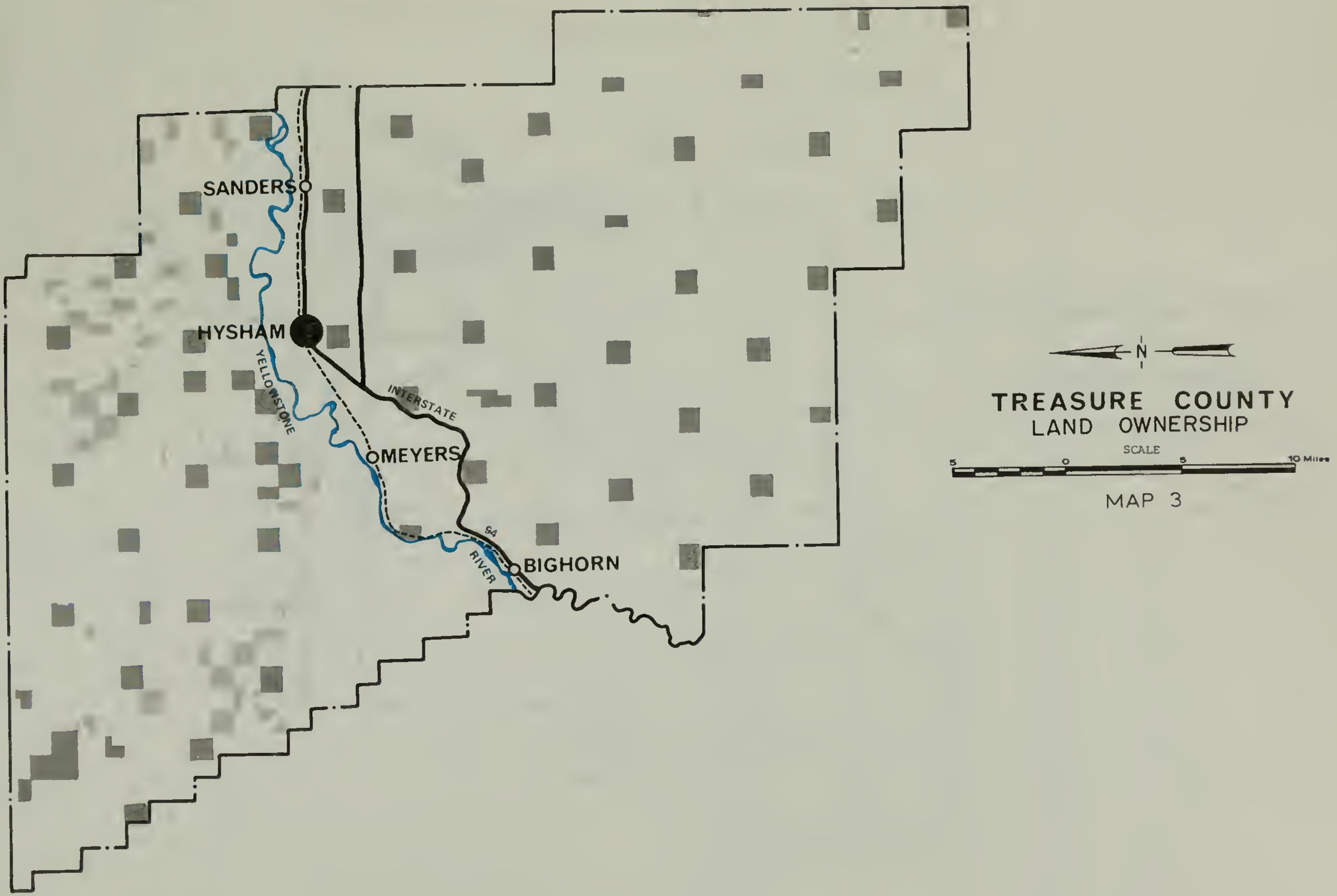
POWER and GAS SYSTEMS & RECREATION AREAS

MAP 2



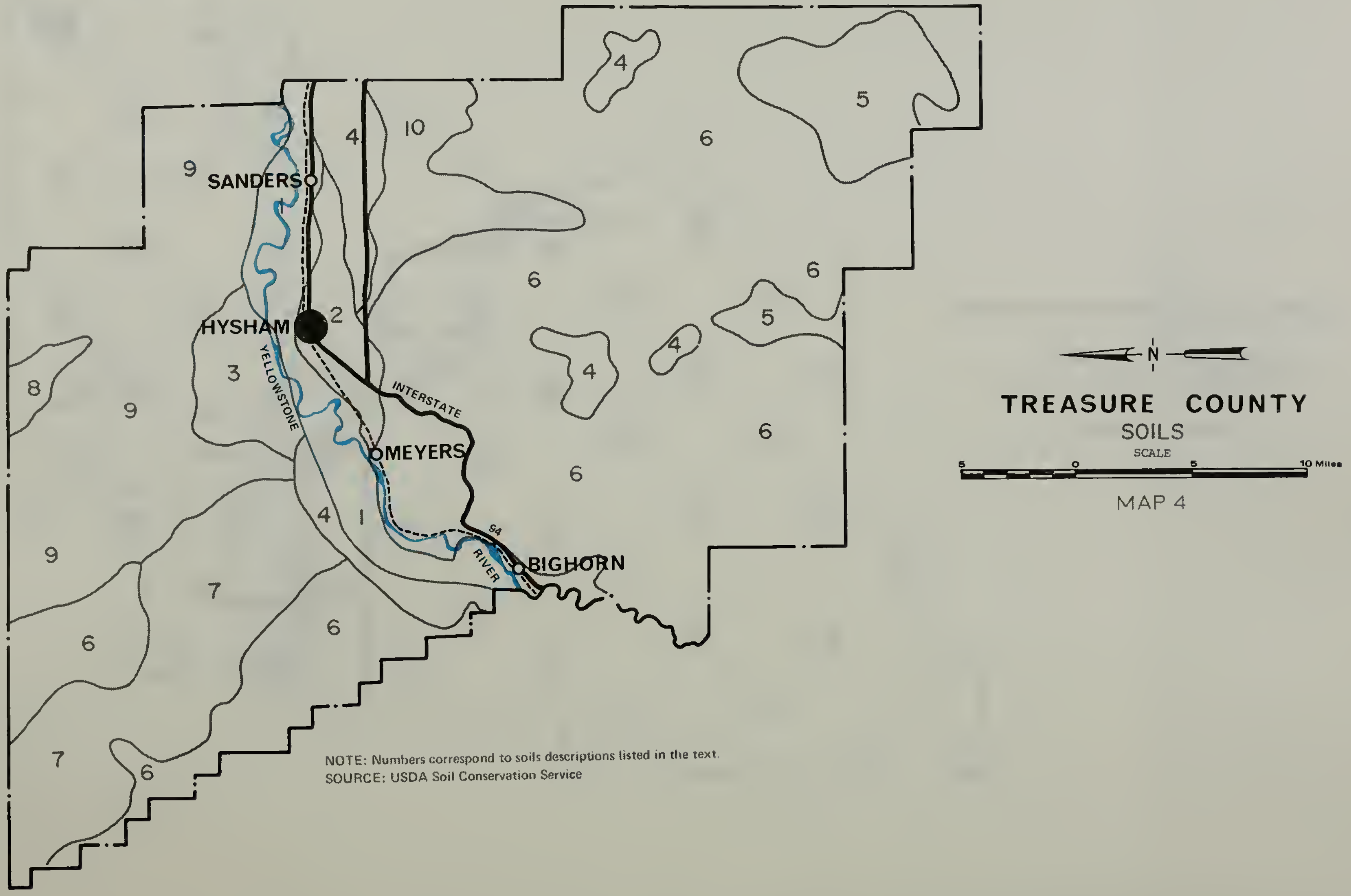
TREASURE COUNTY
LAND OWNERSHIP

MAP 3



TREASURE COUNTY
LAND OWNERSHIP

MAP 3

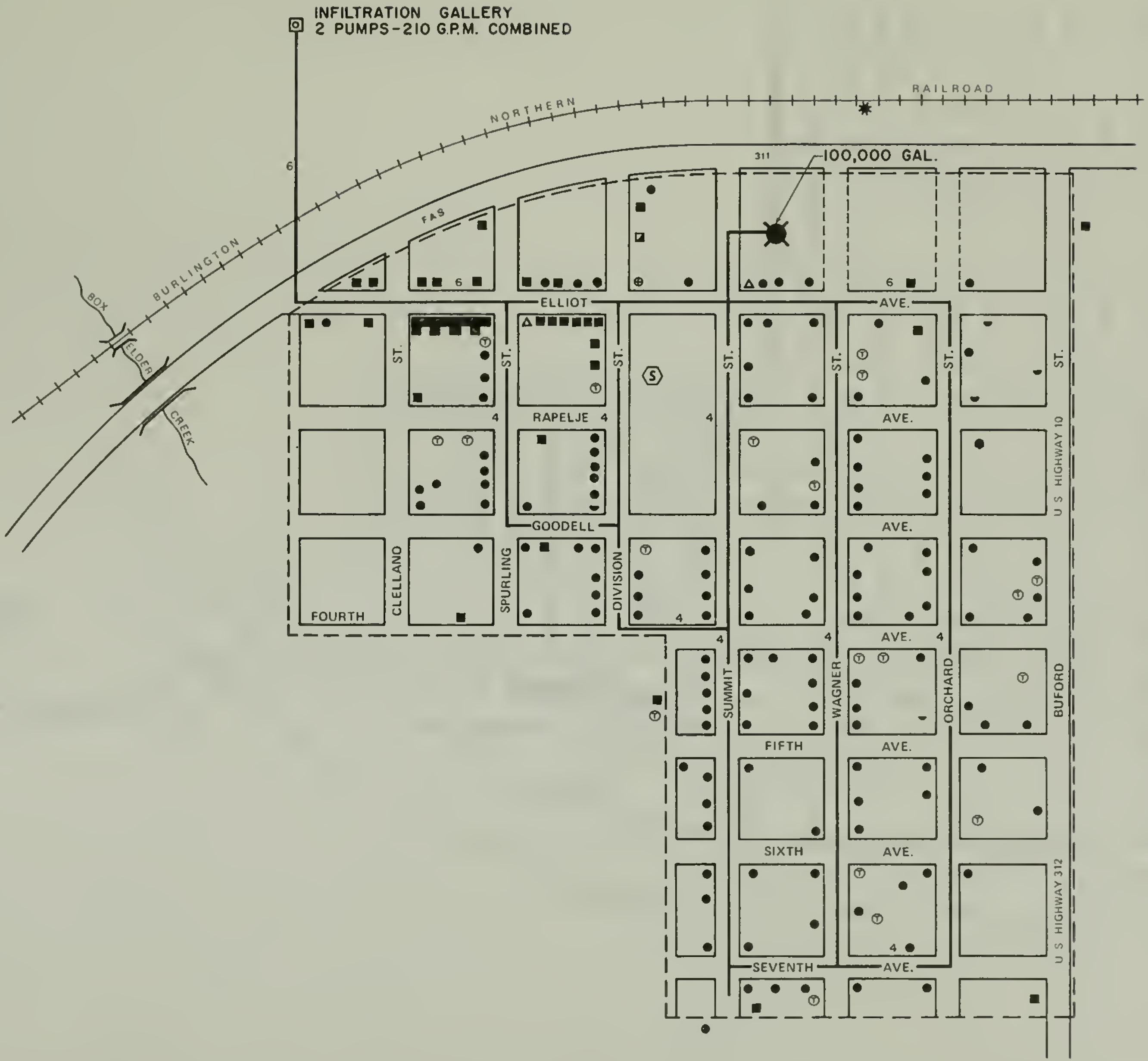


TREASURE COUNTY

SOILS

MAP 4

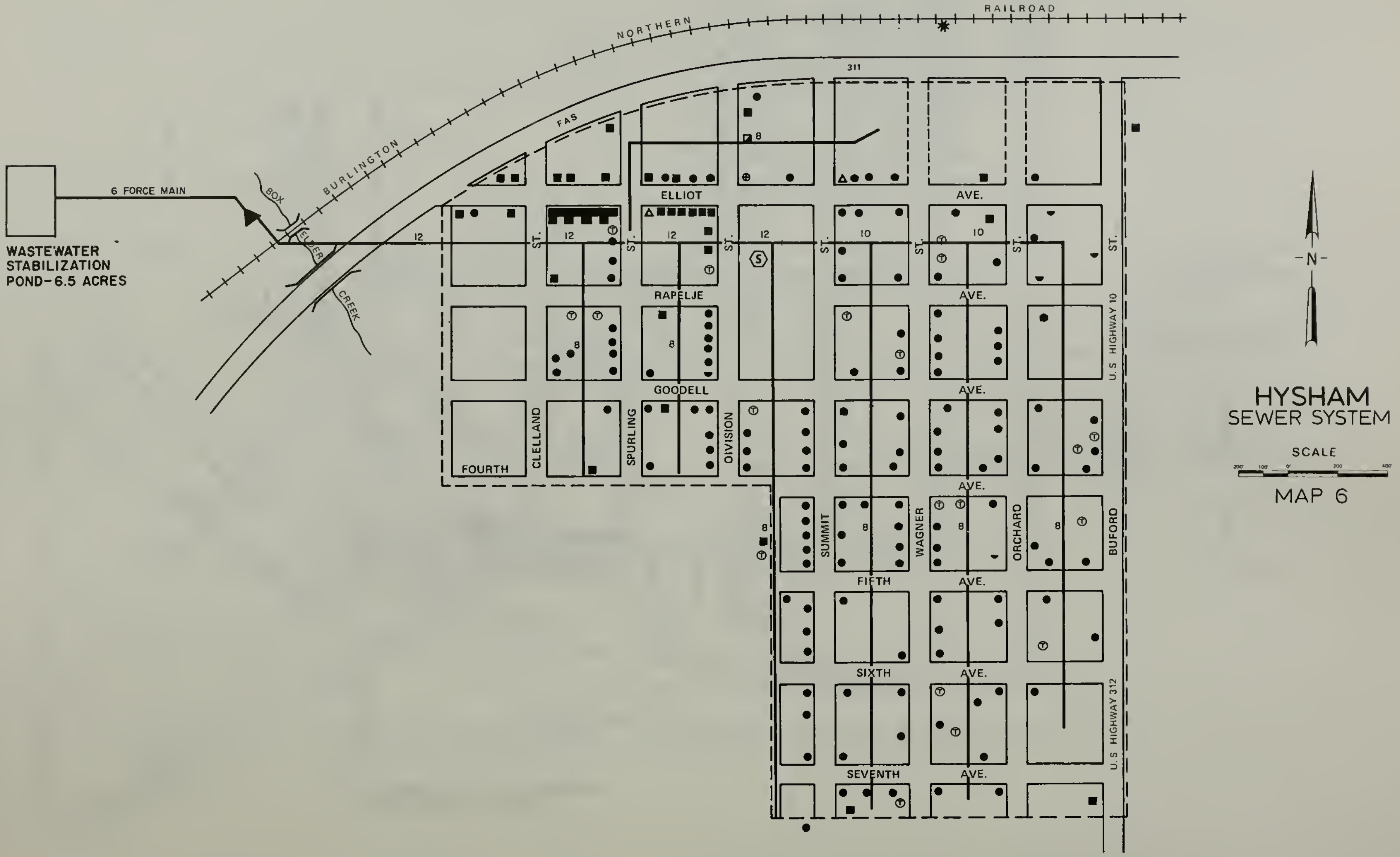
NOTE: Numbers correspond to soils descriptions listed in the text.
SOURCE: USDA Soil Conservation Service



HYSHAM
WATER SYSTEM

SCALE

MAP 5



HYSHAM
SEWER SYSTEM

MAP 6

ROSEBUD COUNTY

MONTANA

ROSEBUD COUNTY

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CONCLUSIONS, RECOMMENDATIONS, AND PRIORITIES

Conclusions

Rosebud County is expected to decrease in population during the planning period. Some of the towns such as Ashland and Lame Deer are expected to show increased population, however. All of the other communities will decrease in population; although, the actual percentage is quite small. The rural areas of the county will account for most of the decrease.

The existing sewer and water systems presently in operation throughout the county are in generally good condition; however, minor repair and replacement are necessary in practically all cases. Some expansion and updating will be necessary for many of the existing systems. Some of the smaller communities could feasibly construct community sanitary facilities, and in some cases the improvements are very much needed. Community systems have been proposed for all communities in the county where feasible; however, in some cases the local demand for the improvement has not developed.

Recommendations

This plan shows the various types of improvements which the communities should be considering during the planning period. Elaborate systems are not proposed but rather those facilities necessary to provide safe and adequate community systems. It is recommended that this general plan be adopted by the governing agencies of each community. A detailed approach, which must be undertaken to insure completion of the improvements in each community, cannot be covered in a report of this type. Community leaders, however, do have several courses of action which may be taken.

Most small communities do not have the means to plan and finance complete water and sewer systems. Therefore, to enable communities to acquire such facilities, five departments of the Federal Government have legislation authorizing loans or grants for construction of public works. These agencies are:

Farmers Home Administration
United States Department of Agriculture
P.O. Box 850
Bozeman, Montana 59715

Federal Water Quality Administration
United States Department of the Interior
% Montana State Department of Health
Helena, Montana 59601

Public Health Service
United States Department of Health, Education, and Welfare
Division of Indian Health
Billings, Montana 59101

Administration for Metropolitan Development
United States Department of Housing and Urban Development
Assistant Regional Administrator
Denver Regional Office
1050 South Broadway
Denver, Colorado 80209

Economic Development Administration
United States Department of Commerce
Montana Field Coordinator
207 Medical Arts Building
Butte, Montana 59701

The legislation is constantly changing; therefore, community leaders should investigate the various alternatives and determine which program and course of action would be most beneficial to them.

Priorities

That a particular system requires immediate improvements and another system will be satisfactory for a definite period are difficult to establish. Several indicators for establishing priorities are available, however. The general health of the people is the prime consideration, and this can only be insured when safe water supplies are provided. Water supply in adequate quantities is another important factor. Waste water must be treated and disposed of by safe methods to minimize the problems of pollution and to protect public health. The total number of persons benefited by any improvement must also be considered. These basic criteria were used in establishing the following priority listing:

1. Ashland Water System. There is sufficient population presently residing here to make this project feasible. Improved water supply and the reliability of a central system are a necessity in this community.

2. Ashland Sewer System. There is sufficient population and

population density to make this project necessary. Improved sanitary facilities are a feasible and worthwhile improvement for this community.

3. Forsyth Sewer System. Elimination of a potential pollution problem makes the project necessary. There is sufficient population to make the project feasible.

4. Lame Deer Sewer System. Elimination of a potential pollution problem makes this project necessary. There is sufficient population presently residing here to make the project feasible.

5. Lame Deer Water System. Increased water supply is a necessary improvement for this community, and there is sufficient population here to make the project feasible.

6. Rosebud Water System. Improved sanitary facilities are a worthwhile improvement for this community. The local demand has not developed, but there is sufficient population to make the project feasible.

8. Ingomar Sewer System. Improved water supply is a worthwhile improvement for this community. The local demand for the improvement has not developed; however, there is sufficient population to make the project feasible.

9. Birney Day Village Sewer System. Improved sanitary facilities are a very necessary improvement for this community. There is sufficient population here to make this project feasible.

10. Birney Day Village Water System. Additional water supply is a necessary improvement for this community. There is sufficient population here to make the project feasible.

This list of priorities is not intended to govern the order in which action should be taken. The order merely ranks the severity of the problems and the need for improvements.

THE LAND

General Characteristics

Rosebud County is located in the east central portion of the State of Montana and is bordered by seven counties within the state. Garfield and Petroleum Counties border to the north while Custer and Powder River Counties form the eastern edge of the county; Big Horn County borders to the south and with Treasure and Musselshell Counties forms the western border. The total area is 5,042 square miles of which ten square miles represent water surface. The Yellowstone, Tongue, and Musselshell Rivers and other creeks and streams account for the water surface area.

As seen by the topography on Map 1, the county is characterized by rolling hills in the southern areas and flat plains and prairies in the northern portion. Elevations vary from 4,457 feet above sea level in the Little Wolf Mountain Range to 2,520 feet where the Little Porcupine Creek runs into the Yellowstone River east of Forsyth. The population distribution lies mainly along the Yellowstone River with the county seat of Forsyth as the focal point.

U. S. Highways 10, 12, and 312 and Interstate 94 are all the same highway forming the principal east-west route through the center of the county. This controlled access highway travels from Miles City in the east to Forsyth and continues westward to Billings. U. S. Highway 12 branches off at Forsyth and continues on to Roundup in Musselshell County. State Secondary 315 travels northward from Lame Deer to join Interstate 94 at the interchange west of Forsyth. State Highway 212 serves the southern portion of the county and, traveling east to west through the towns of Ashland and Lame Deer, continues westward to the Custer Battlefield National Monument. Numerous other state secondary and county roads serve the outlying areas.

Two railroads provide service to the county. The main line of the Burlington-Northern crosses the central part of the county, connecting Miles City in the east to Hysham in the west; a spur line forks southward out of Forsyth and terminates at Colstrip. Two passenger trains, the North Coast Limited and the Mainstreeter, serve the area four times daily. Numerous freight trains also travel the route each way. The Chicago, Milwaukee, St. Paul, and Pacific also provides freight service and parallels the main line of the Burlington-Northern. From Forsyth this line forks northwestward to Roundup, paralleling U. S. Highway 12. The freight car service provided by these lines plays an important role in the agricultural economy of the area.

Although there are no commercial airports in the county, Forsyth does operate a paved, public, 2,500 foot landing strip with limited aircraft servicing facilities. Ashland has an unpaved public landing strip of 3,600 feet but provides no services. Daily air service and connections to nation wide airlines are available at Miles City and Billings.

The Montana Power Company and the United States Bureau of Reclamation are the main suppliers of electrical power to the county. Local distribution is accomplished by two cooperatives. Mid-Yellowstone Electric Cooperative serves the north and northwestern area with Hysham as the main distribution point, and the Tongue River Electric Cooperative serves the remaining county area with Lame Deer, Ashland, Colstrip, and Birney being the main distribution points.

Since major power producing centers and relay stations are usually located at widely separated points and provide power service to large areas, Map 2 shows the major power grid system for the entire State of Montana. Major gas transmission lines are also shown.

Telephone service to the county is provided by two telephone companies and two cooperatives. The Mountain States Telephone Company serves the central area of Forsyth and the northwestern Section of the county county. The Hysham Telephone Company serves Hysham and its immediate environs. The Range Telephone Cooperative provides service to the east and southern sections where the towns of Rosebud, Ashland, and Birney are located. Mid-Rivers Telephone Cooperative services the northeastern corner which includes Rock Springs and its immediate environs.

Land Ownership and Use

As seen on Chart 1, there are three main types of landowners in Rosebud County. The largest segment of land, seventy six percent or 3,832 square miles, consists of private ownership. Eleven percent, 555 square miles, is federal, and tribal lands of the Northern Cheyenne Indian Reservation claim 353 square miles, seven percent. The remaining six percent of the land is state owned.

The land use pattern generally reflects the physical characteristics of the county. Eighty seven percent of all lands are used for agricultural purposes, thus reflecting the suitability of the land for grain and livestock production. Forest and commercial uses each occupy five percent of the land. The remaining three percent consists of water surface area and land used for town sites, transportation routes, and other non agricultural uses.

Natural Resources

Natural resources have played an important role in the economy of Rosebud County. One oil field, Sumatra Field, opened in 1949, is still producing sizeable amounts of crude petroleum ranking this resource number one in the county. In 1968 the field produced 738,081 barrels of crude oil for an average of 2,017 barrels a day. Because of the extensive bentonite mining operations, clays rank second in

CHART 1

Land Ownership
Rosebud County

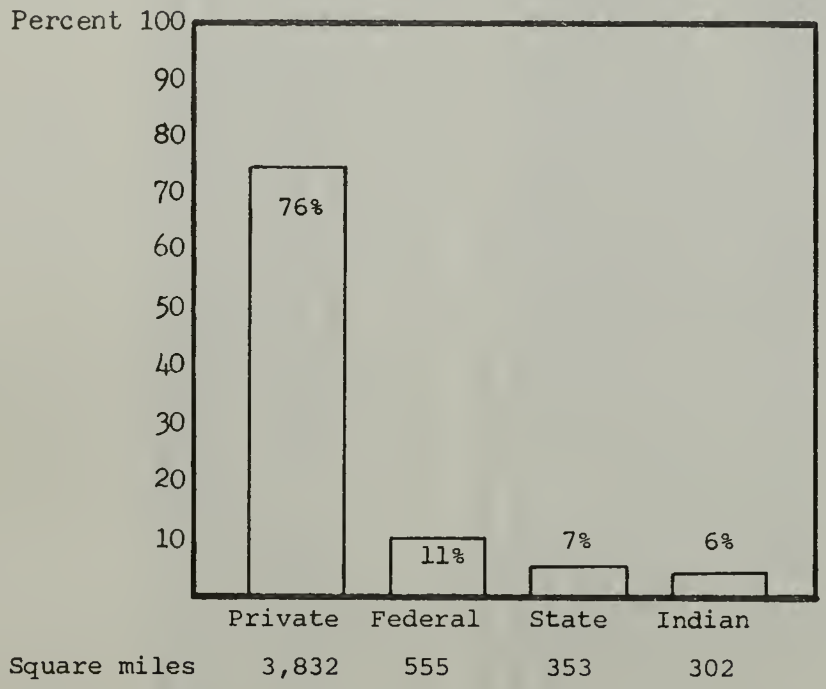
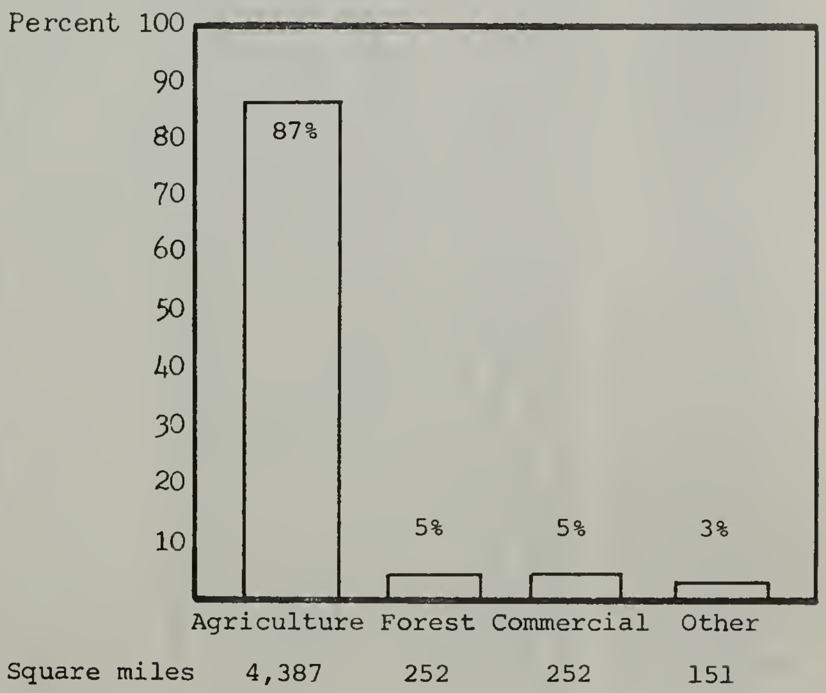


CHART 2

Land Use
Rosebud County



Sources:
1. The Montana Almanac, 1959-60
2. Bureau of Indian Affairs, U. S. Department of the Interior
3. U. S. Census of Agriculture, 1964

economic importance to the county. Bentonite is chiefly mined from the Hallite Minerals Company mine near Vananda and is shipped to Duluth, Minnesota for processing into a product suitable for use as a binder in pelletizing taconite iron ore concentrate.

Coal is also mined in the county which is included in the Fort Union Coal Region. The sub-bituminous rank coal area includes the fields of Forsyth, Rosebud, Ashland, and Birney. The coal mined is classified as clean and of good quality.

In 1967 minerals produced included petroleum, clays, sand, gravel, and stone. Stone is produced for use in highway construction projects. Sand and gravel are also used primarily for road construction as well as for commercial and residential building construction.

Rosebud County offers a variety of outdoor recreation to county residents and tourists. Trout are found in the streams of the area, and the big game hunter will find deer and antelope on the rolling hills and plains. Sage grouse, sharptail, and Hungarian partridge are also available to the upland game bird hunter. Camping, hiking, and picnicking are enjoyable area activities, and excellent facilities are provided for each.

Soils

The soils of Rosebud County are those of grass and crop land supporting types with the majority used for livestock production. Most of these lands are quite fertile and normally quite productive when sufficient moisture is available or when under irrigation. Extensive areas of alluvial soils occur along the Yellowstone River.

Soils are covered in more detail later in this report.

Water

The Yellowstone River, a principal stream of Montana, flows through the center of the county, drains the southeast corner of the state, and then joins the Missouri River just beyond the North Dakota-Montana state line. The Musselshell River on the extreme northwestern boundary line, along with the Big Porcupine Creek, drains the northwestern region while Sunday Creek drains the northeast region. Rosebud Creek and the Tongue River drain the southern county area. All the above creeks are tributaries of the Yellowstone River.

Water resources are covered in more detail later in this report.

THE PEOPLE

Population

For analytical and projective purposes, it is necessary to study the population history of Rosebud County to find out what has happened and what is going to happen. Chart 3 graphically shows the growth of the county as compared with that for Montana and indicates the future growth for both.

With the exception of 1950, the number of persons living in the county has decreased every decade since 1920. The figure for 1950 was just over one percent higher than that recorded ten years earlier. The largest population drop occurred during the depression and drought years of the 1930's when almost twelve percent of the inhabitants moved from the county. The estimated 1970 population is seventy one percent of the 1920 population, and the projected 1990 figure drops to sixty percent.

In 1960 Rosebud County was classified as a rural area containing no urban areas and being located neither in nor near a major aggregate of urban population. Table 1 indicates that the urban population has grown while losses occurred in the rural areas. Even though the farm population has lost numbers, growth is noted in the rural non farm areas at a rate greater than for the urban population. During the past twenty year reporting period, the urban population has continued to represent a larger portion of the total number of persons living in the county. This category represented twenty nine percent of the total in 1950 and then advanced to thirty three percent in 1960 and thirty five percent in 1970. A shift has also been taking place in the rural population. Persons on farms accounted for over one third of the population in 1950, then dropped to a fourth in 1960, and to one sixth presently.

The rural non farm group advanced from thirty four percent in 1950 to an estimated current forty nine percent.

From 1950 to 1960 the population decreased by 383 persons. Chart 4 indicates that the decrease is a result of a net migration loss of 1,494 persons and an excess of 1,111 births over deaths.

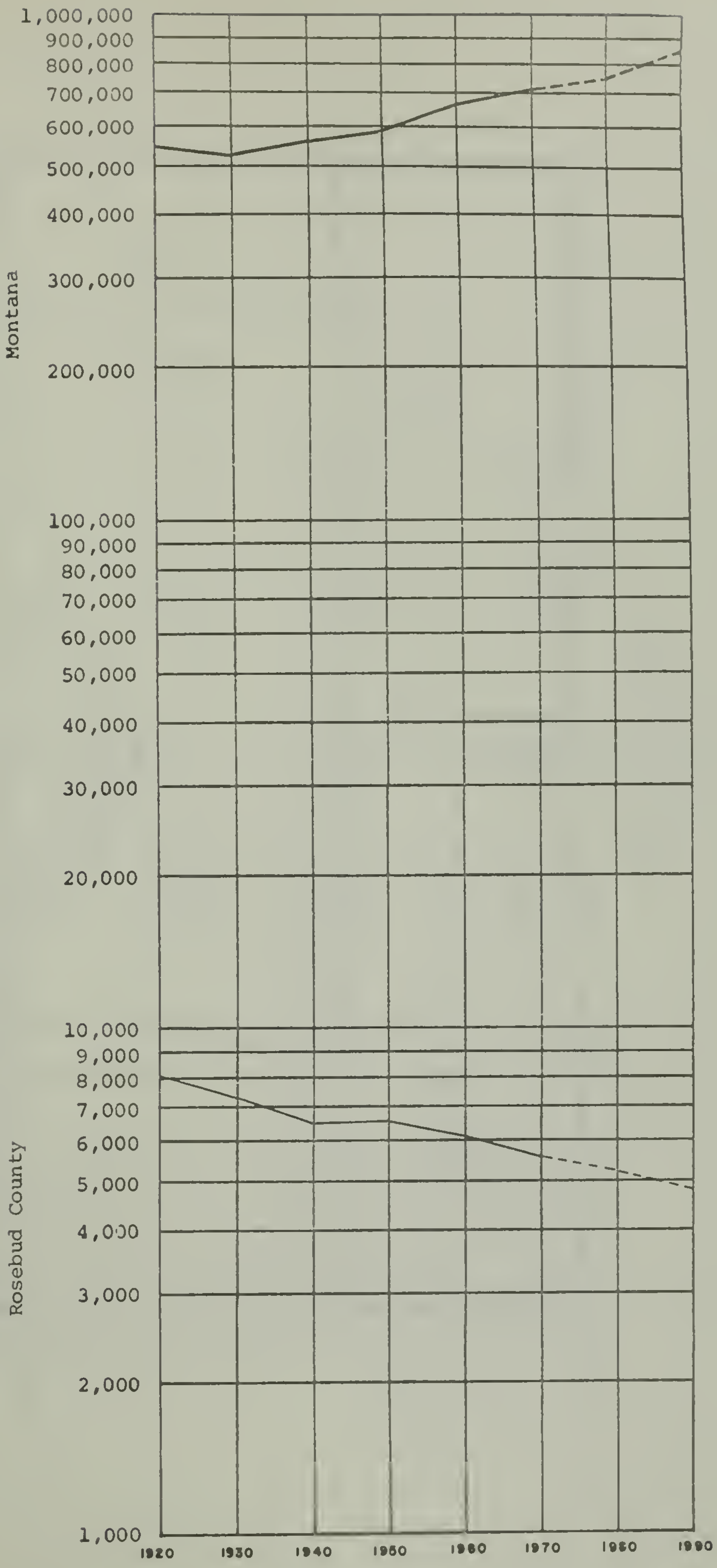
The change in sex composition from 1950 to 1960 is shown in Chart 5. Over the ten year period the ratio of males to females closed slightly. The ratio should not change significantly throughout the planning period.

The age distribution by sex for 1950 and 1960 is shown in Table 2.

CHART 3

COMPARATIVE
POPULATION
TRENDS

Rosebud County
and Montana

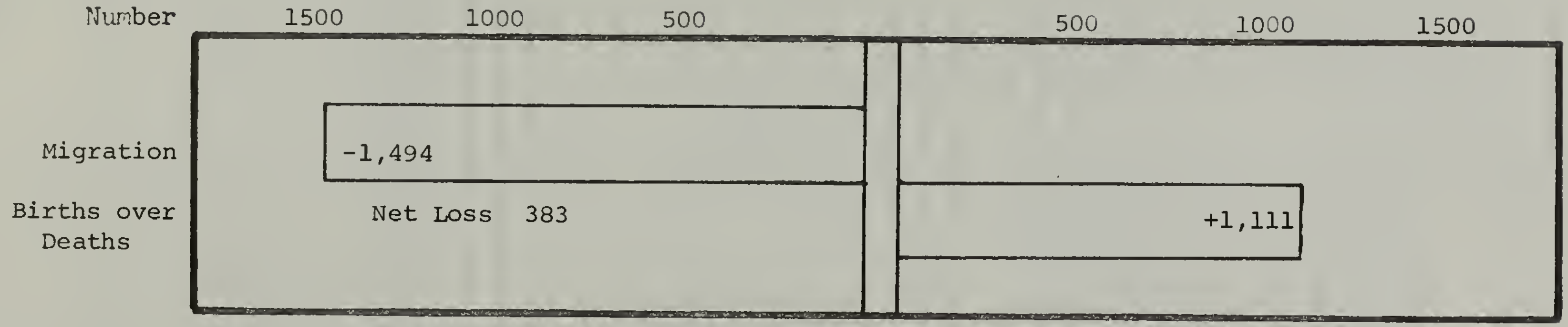


Sources:

1. U.S. Census of Population
2. Intermountain Planners, Inc.

CHART 4

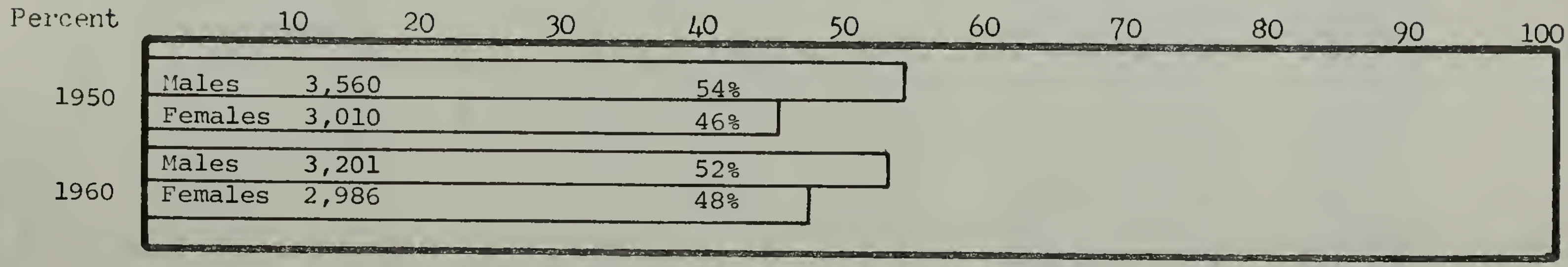
Population Change
Rosebud County 1950 - 1960



Source: Net Migration of Population, 1950–1960 by Age, Sex, and Color, U. S. Department of Agriculture

CHART 5

Population by Sex
Rosebud County 1950 - 1960



Source: U. S. Census of Population, 1950–1960

With few exceptions, most of the growth occurred within the older age groups.

TABLE 1

Urban-Rural Population Changes for Rosebud County

1950-1970

	1950	1960	Changes	1950-1960
			Number	Percent
Total	6,570	6,187	-383	- 5.8
Urban (Inc. Towns)	1,906	2,032	+126	+ 6.6
Rural	4,664	4,155	-509	-10.9
Farm	2,428	1,559	-869	-35.8
Non Farm	2,236	2,596	+360	+16.1

	1960	1970	Changes	1960-1970
			Number	Percent
Total	6,187	5,700	-487	- 7.9
Urban (Inc. Towns)	2,032	2,000	- 32	+ 1.6
Rural	4,155	3,700	-455	-11.0
Farm	1,559	900	-659	-42.3
Non Farm	2,596	2,800	+204	+ 7.9

Sources: 1. U. S. Census of Population, 1950-1960

2. Intermountain Planners, Inc.

A total of seven towns and communities were studied in Rosebud County. The list includes the incorporated town of Forsyth and the seven unincorporated communities of Ashland, Birney, Birney Day Village, Lame Deer, Rosebud, and Ingomar. The communities of Angela, Hathaway, Rock Springs, Sumatra, and Vananda were also studied but were not included within this report because of insufficient population and development. The community of St. Labre Mission was not covered by this report because it is a Bureau of Indian Affairs self contained complex, and the community of Colstrip was excluded as it is a

TABLE 2

Age & Sex Composition of Rosebud County

Age Group	1950 Male	1950 Female	1960 Male	1960 Female
Under 5	432	408	419	387
5-14	636	581	734	687
15-19	278	214	239	237
20-24	232	237	134	157
25-34	498	442	327	356
35-44	443	384	414	368
45-54	365	267	328	293
55-64	378	259	254	210
65-74	199	151	251	193
75 +	99	67	101	98
Total	3,560	3,010	3,201	2,986

Source: U. S. Census of Population, 1950-1960

TABLE 3

Population Forecast for Towns and Communities

Rosebud County

	1950	1960	1970	1975	1980	1990
Ashland	100	150	400	450	500	600
Birney	50	20	15	12	10	5
Forsyth	1,906	2,032	2,000	1,950	1,900	1,700
Birney Day Village	NA	NA	100	110	125	150
Lame Deer	350	300	1,100	1,150	1,200	1,400
Rosebud	250	140	100	85	75	50
Ingomar	80	65	50	55	50	40

Sources: 1. U. S. Census of Population, 1950-1960

2. Intermountain Planners, Inc.

privately owned, company town.

Because of the time that has elapsed since the 1960 Census, current population estimates had to be derived from several sources in the field. Surveys and interviews were conducted to determine what now exists and what is expected in the future. Table 3 indicates the past population and future forecasts for each town and community in the county.

The incorporated town of Forsyth will remain the largest urban area in the county throughout the twenty year planning period. The number of persons in the town will decrease by three hundred persons by 1990. The fifteen percent decrease will be a result of a lessening economic attraction for the area.

The community of Lame Deer will increase by more than a fourth throughout the planning period. An additional eighty five new dwelling units will be needed in the next twenty years to accommodate the growth which is expected to occur within the existing community and along its fringes.

A thirty percent population gain is forecasted for Ashland over the next twenty years. An additional forty new dwelling units will be needed to house the growth, and the development should occur in the area north of the existing community.

A fifty percent population growth is expected to occur in Birney Day Village by 1990. The estimated twenty new dwelling units will be built within the existing community.

Population in the remaining communities is expected to decrease over the next twenty years.

The population figures reflect only those factors and trends for which information is available. New technological advances, new industries, or other unforeseen events may alter these projections. If such an event occurs, the areas affected should be studied in light of the new conditions.

Housing

There were 1,989 housing units within Rosebud County in 1960. According to Chart 6, three fourths of all housing was classified as rural non farm with the remainder as farms. Since the county lacked any recognizable urban center in 1960, there was not any urban classification of housing units as found elsewhere in Montana. The median housing unit size was 4.10 rooms per unit, and the median

HOUSING

Rosebud County 1960

Chart 6

Housing Classification

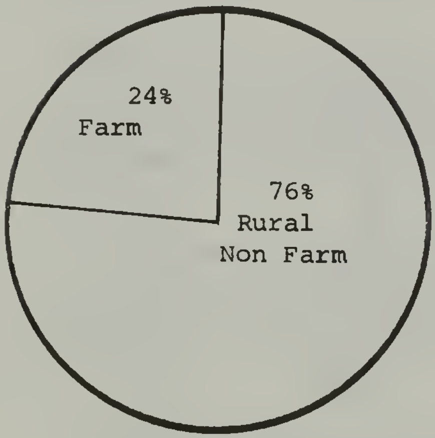


Chart 7

Housing Tenure

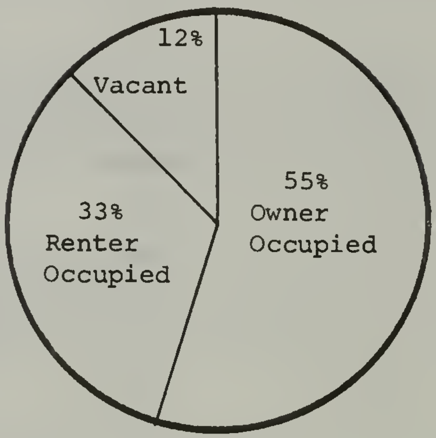
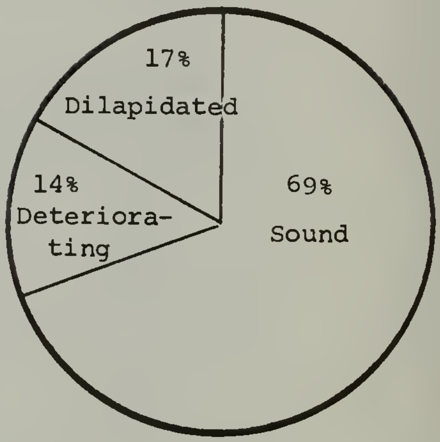


Chart 8

Housing Condition



Source: U. S. Census of Housing, 1960

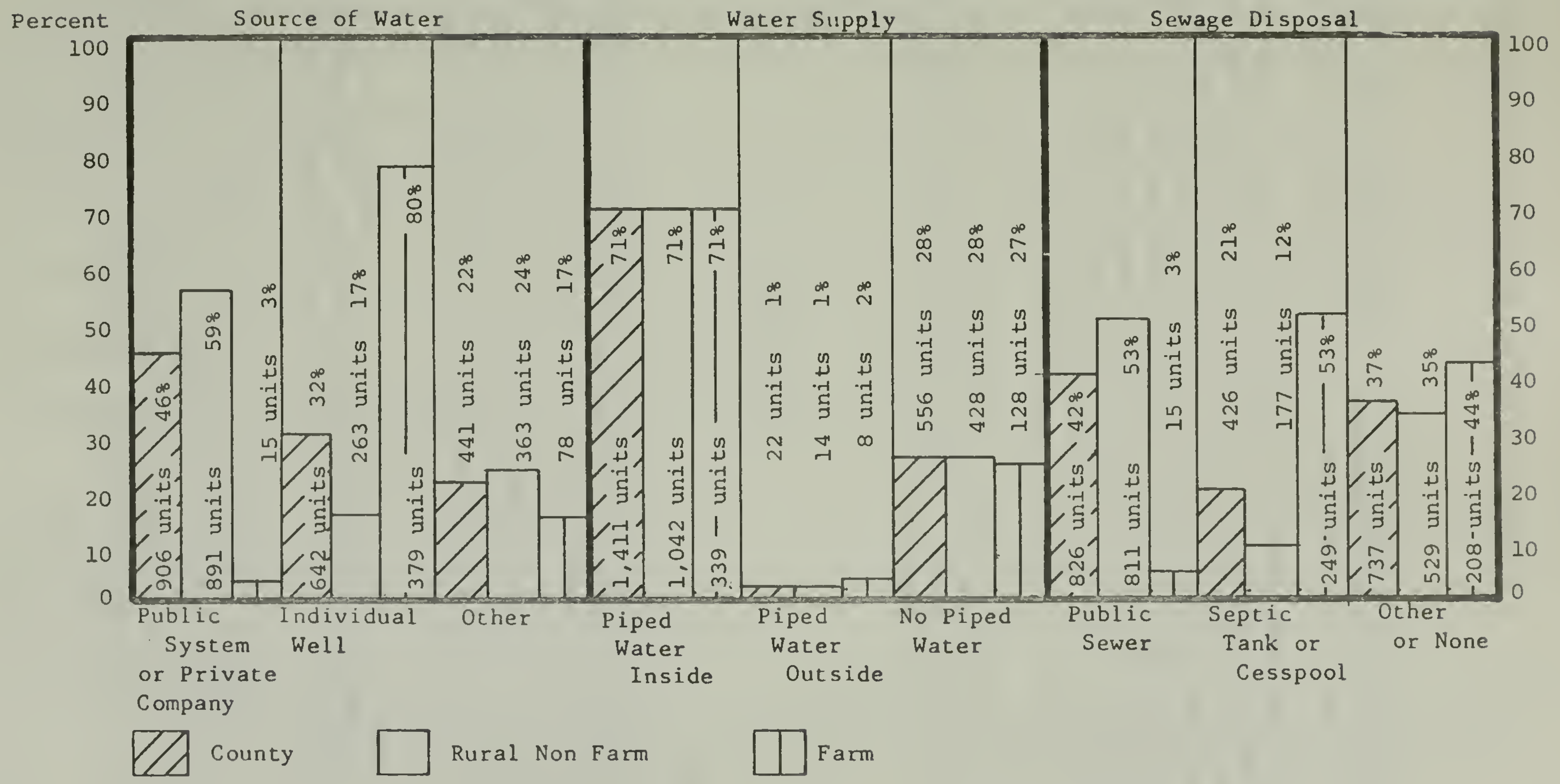
household size per occupied unit was 3.51 persons. Just over half of all units were owner occupied in 1960, and another third were used for rental purposes. Chart 7 indicates that one unit in eight was vacant. The condition of housing in 1960 is reflected in Chart 8 which indicates that one housing unit in six needed replacement, while one in seven needed repair; the remainder were classified as sound.

Chart 9 reflects the 1960 status of housing units in terms of source of water, water supply, and method of sewage disposal. For geographical reference, the data shows the status for Rosebud County as a whole and for the farm and rural non farm housing units.

Just under half of all homes in 1960 were served by either a public water system or by a private water company. Those served included fifty nine percent of homes in the rural non farm areas and three percent of the farms. About one third of the homes used individual wells for water. Seventeen percent of the rural non farm homes and eighty percent of the farms used this method for obtaining water. One home in five, including one fourth of homes in the rural non farm areas and one farm in six, relied on still another method for water.

CHART 9

Sewer and Water
Rosebud County 1960



Source: U. S. Census of Housing, 1960

Census data indicates that twenty eight percent of all homes in the county did not have piped water in 1960. This figure included equal percentages from the rural non farms as well as the farm areas.

About the same number of homes served by a water system were also served by a public sewer system. Those served included forty two percent of all homes, just over half of the rural non farm homes, and three percent of all farms. More than one fifth of the homes, including one rural non farm home in eight and over half of the farms, relied on either septic tanks or cesspools for sewage disposal. Thirty seven percent relied on still another method for waste disposal. This figure included thirty five percent of the rural non farm homes and forty four percent of the farms.

The rural non farm homes, which includes all urban centers in the county, had about half of all the homes served by a public water or sewer system in 1960. Efforts should be made to provide service to the remaining homes in this category.

THE ECONOMY

Labor

People have a direct relationship on the economy of an area because of their role as both producers and consumers of goods and services. The following economic analysis of Rosebud County is concerned primarily with the total economic spectrum and how it may affect the future of the area. Changing economic conditions can have either a good or a bad effect in terms of population growth, ability to provide for public improvements, or in determining the general overall living environment.

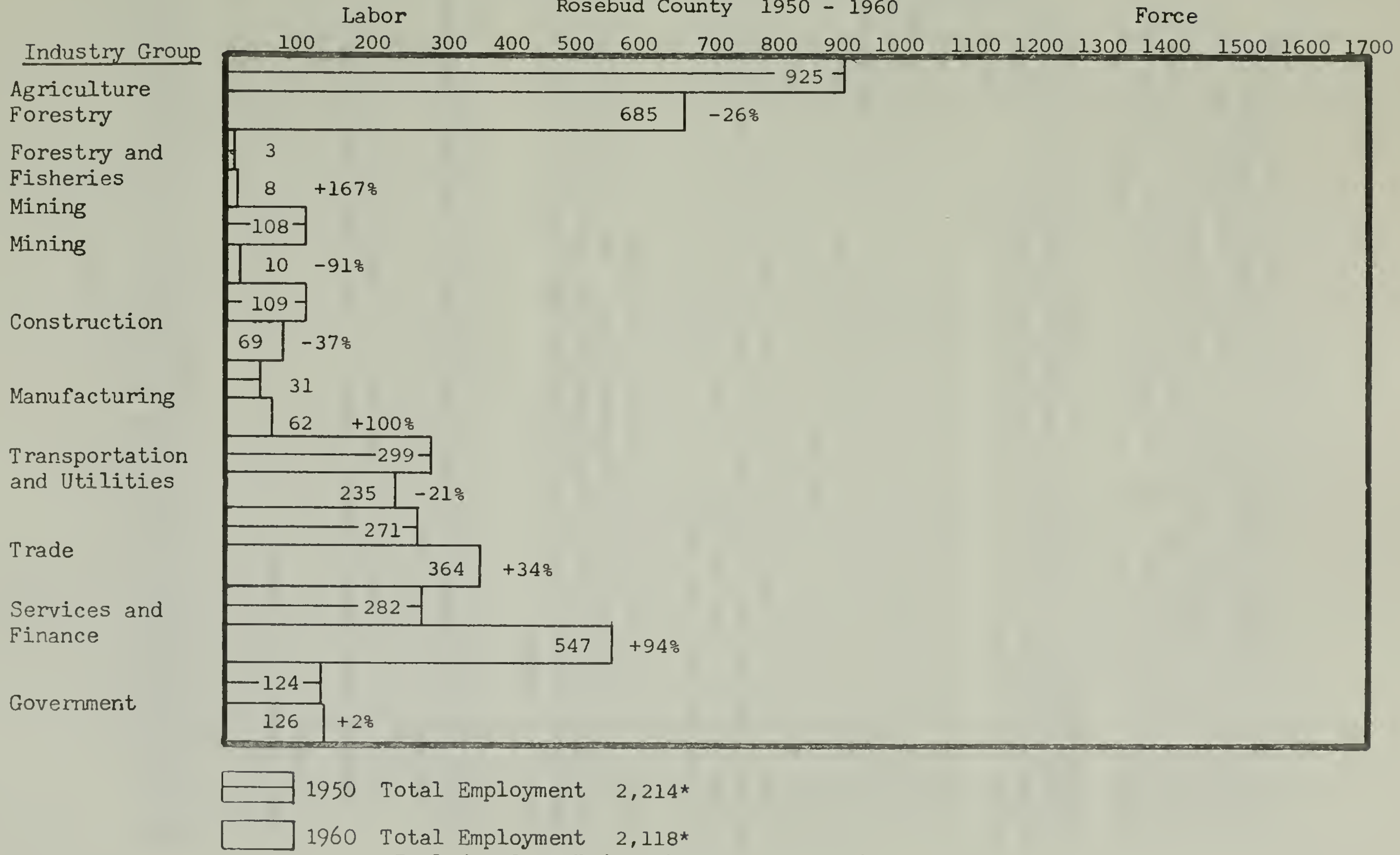
Employment in the county dropped by four percent between 1950 and 1960 as compared to a six percent population loss. The employment decline is contrasted with a six percent gain for Montana during the same period.

Past employment change by major industry groups is shown in Chart 10. Over the period, moderate contractions of employment and labor force were confined to males. In contrast, women in the labor market increased by sixty percent while their share of jobs rose from sixteen to twenty eight percent. Agriculture accounted for about half

CHART 10

Employment Change by Major Industry Group

Rosebud County 1950 - 1960



Source: U. S. Census of Population, 1950-1960

of all job losses while mining, and transportation and utilities accounted for another twenty and thirteen percent respectively. Because of the added use of diesel machinery, employment cuts were realized which affected rail and coal mining labor needs. Services and finance accounted for nearly seven tenths of the employment gains and achieved its highest gain in relative importance in southeastern Montana. Trade accounted for over a fifth of the employment gains.

Partial shopping facilities and services were available in Forsyth, but the majority of goods and services were provided in Miles City. The county lies within the Billings primary retail and wholesale market but relies on Miles City to a larger extent.

An analysis into the employment characteristics of the trade and the services and finance groups gives an insight into the reliance the economy has on other areas in providing goods and services. In the trade segment one worker in five was employed in eating and drinking sales while only two percent represented wholesale trade. The majority of persons in the group, almost three out of four, were in retail sales. One in four persons in the services and finance industry group represented non profit organizations while only six percent represented professional services. The education field attracted more than one fourth of the group, and one person in seven provided personal services.

Percentages for employment by industry group shown in Table 4 provide an insight into local labor characteristics. The table shows the relative weight of each industry group in the county and offers a comparison with that existing in 1960 for the State of Montana and the United States.

About one third of all labor in the county was in agriculture. The local employment rate was almost double that for the state and three times that for the nation.

The services and finance industry was at a comparable level to that for Montana and sixty percent higher than for the United States.

The employment levels for construction and manufacturing were considerably lower than those for the state and the nation. This characteristic is common in an area which is agriculturally oriented.

Labor statistics are reported on an annual basis by the Employment Security Commission of Montana. The data for 1969 indicates more job gains and more job losses over that reported in 1960. The mining

TABLE 4

Percent of Total Employment by Industry Groups

Rosebud County, Montana and United States

1960

	Rosebud County	Montana	United States
Agriculture	32	17	11
Forestry and Fisheries	1	1	1
Mining	1	3	1
Construction	3	7	5
Manufacturing	3	10	27
Transportation and Utilities	11	9	7
Trade	17	21	19
Service and Finance	26	27	16
Government	6	6	13
Total	100	100	100

Source: U. S. Census of Population, 1960

industry which includes mineral fuel exploration operations expanded three hundred percent. The manufacturing segment also increased by 128 percent. Losses were noted for the remaining industry groups.

Unless the mineral fuel industry expands significantly, agriculture will continue to dominate county economic activities.

Agriculture

A farm is defined in the United States Census as a place having at least ten acres of land devoted to agriculture and selling at least fifty dollars worth of agricultural products annually. According to Chart 11, there were 382 farms in Rosebud County in the above category in 1964, one percent fewer than there were in 1959.

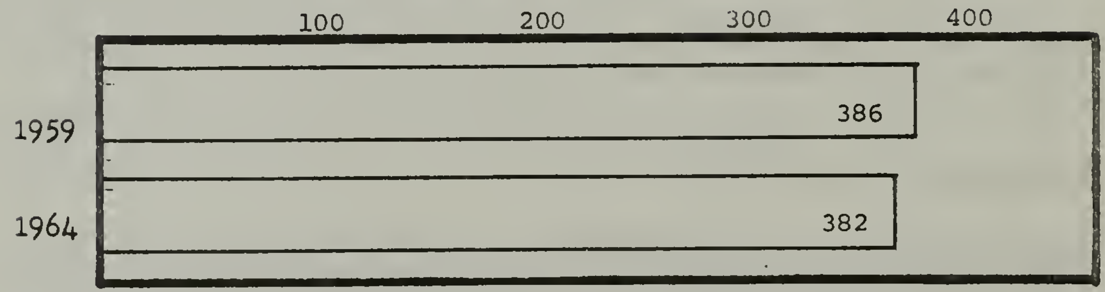
The 1964 classification of farms by type was as follows:

Field crop farms other than vegetables, nuts, and fruit		80
Cash grain	48	
Other field crops	32	
Poultry farms		1
Dairy farms		3
Livestock farms other than poultry and dairy		223
General farms		30
Miscellaneous and unclassified		45
Total		382

Of the total number of farms, nineteen were classified as part time, and twenty one were classified as being operated by semi retired persons.

CHART 11

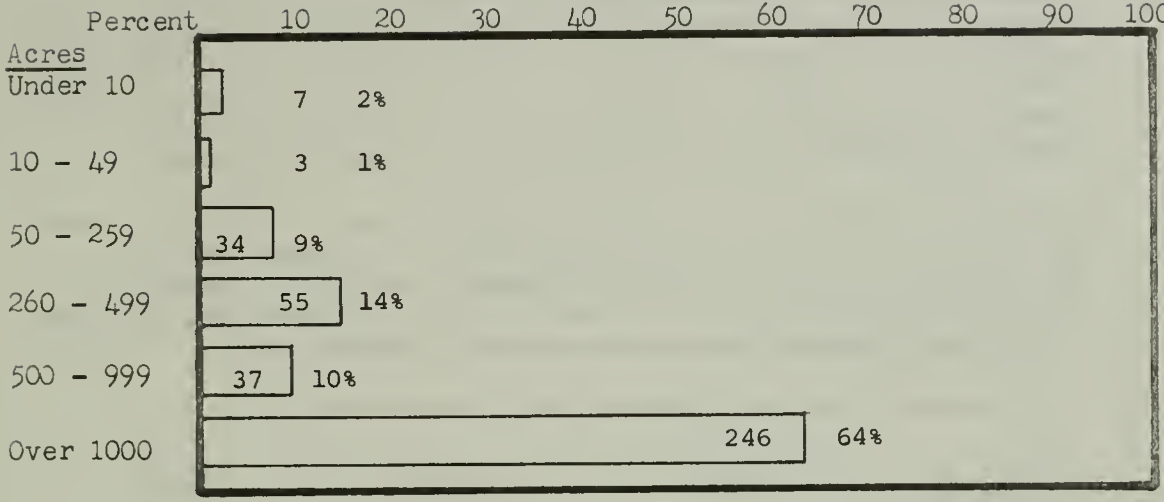
Number of Farms
Rosebud County 1959 - 1964



Source: U. S. Census of Agriculture, 1964

CHART 12

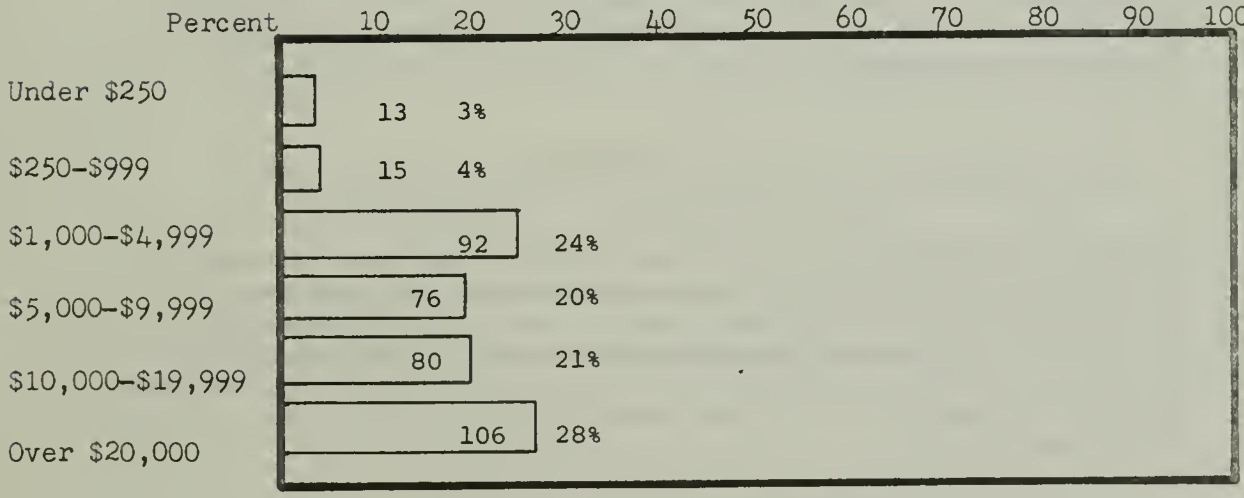
Farms by Size
Rosebud County 1964



Source: U. S. Census of Agriculture, 1964

CHART 13

Number of Farms by Value of Farm Products Sold
Rosebud County 1964



Source: U. S. Census of Agriculture, 1964

Almost three out of five farms were primarily livestock producers while only one fifth of the farms raised field crop products. The above data indicates that twenty percent of the farms were of miscellaneous type or unclassified. In 1964 the average farm was 3,024 acres in size. Chart 12 indicates that almost two thirds of the farms were larger than one thousand acres. At the same time one fourth of the farms were under five hundred acres in size.

The value of products sold by the number of farms is shown in Chart 13. The data indicates that almost half of all farms reported receipts of more than $10,000 for products sold while twenty eight had sales exceeding $20,000. About one third of the farms received under $5,000 for the sale of agricultural products.

Cash receipts data from 1964 to 1967 is as follows:

Year	Livestock	Crops	Total
1964	$4,714,500	$2,432,600	$7,147,100
1965	$5,976,700	$1,829,600	$7,816,300
1966	$7,362,000	$1,978,600	$9,340,600
1967	$6,454,500	$2,210,600	$8,665,100

In 1964 the sale of livestock products represented two thirds of all agricultural products sold. Throughout the four year reporting period sales in that category increased to where livestock accounted for three fourths of total sales.

Between 1959 and 1964 the number of farms decreased slightly in number while the average farm increased in size. It is expected that the same will happen in the future while livestock raising increases in frequency.

THE GOVERNMENT

Before any meaningful consideration can be given to major capital improvement projects, it is necessary to study the governmental organizations in Rosebud County and to analyze their economic structure structure. At present there are two separate, local governmental units in the county involved within the scope of the water and sewer study. Included are the incorporated city of Forsyth and government of Rosebud County.

A Board of County Commissioners presided over by a chairman governs the county. The incorporated municipalities are governed by a mayor council form of government.

In financing capital improvement projects, the incorporated municipalities have power to bond and raise the necessary monies for funding projects. The unincorporated small towns do not have similar power and, therefore, must rely on financing projects through the county government.

Table 5 indicates the financial condition of each unit of government in 1969.

TABLE 5

Financial Status of County Government and Incorporated Cities

Rosebud County 1969*

	Revenue	Expenditures	Assessed Valuation
Rosebud County	$2,732,521.38	$2,629,897.24	$32,302,324.00
Forsyth	178,218.33	158,831.13	1,400,768.00

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* There are several methods presently available to communities for financing water and sewer systems:

1. Incorporated Cities and Towns may use Municipal Bonds, Municipal Revenue Bonds, and Special Improvement District Bonds.
2. Unincorporated Towns may use Rural Special Improvement District Bonds and County Water and Sewer District Bonds.
3. Incorporated Cities and Towns and adjacent unincorporated areas may use Metropolitan Sewer District Bonds.

Source: Information received from each governmental unit

THE WATER RESOURCES

General

The water resources of any area are one of its most important assets. Montana is fortunate in that water is in abundant supply over much of the state. This is especially true in the mountain areas and along the major drainages. Water is essential for many human needs with individual consumption and sanitation being foremost. Industrial and agricultural uses of water are perhaps next most important. The recreational use of water has also become a significant factor in modern day living.

In his use of this resource, man in the past has polluted much of the available fresh water and degraded it to the point where it is unfit for many or all uses. Careful planning for the efficient use of water resources can avert inconveniences caused by pollution.

Water resources, therefore, are an important consideration in the comprehensive planning for community water and sewer systems. In the following portion of this report the existing water resources of the planning area will be briefly reviewed. The discussion will be specifically concerned with the occurrence and availability of both surface and ground water. Also important, and included in Appendix I, are the specific laws and policies of the State of Montana concerning surface and ground-water resources. "Water Quality Criteria," "Water Use Classifications," and "Policy Statements" adopted by the State Department of Health are discussed in detail. Table A in Appendix I outlines present day water quality standards as set forth by the United States Health Service.

Surface-Water Resources

Rosebud County has an extensive drainage system which has primary characteristics of plains topography. Drainage may be found flowing in almost any direction; however, the main drainage pattern is toward the Yellowstone River valley in central Rosebud County.

Elevation differences are not excessive and the complex surface drainage system is mainly attributed to the somewhat rugged hill and valley topography. In general, the highest elevations, over four thousand feet above sea level, occur in southern Rosebud County and the lowest elevation, about 2,500 feet above sea level, occurs where the Yellowstone River leaves the county east of Hathaway.

The major drainage features are the Yellowstone, Tongue and

Musselshell Rivers. The Yellowstone River enters Rosebud County east of Forsyth and flows approximately forty miles east of Forsyth and flows approximately forty miles east before entering Custer County southwest of Miles City. The Tongue River enters Rosebud County at the extreme southwestern corner of the county and flows northeasterly across the southern portion of the county for more than fifty miles before entering Custer County near Brandenberg. The Musselshell River forms the county line between Rosebud, Musselshell, and Petroleum Counties for approximately twenty miles in extreme northwestern Rosebud County. A small portion of the drainage from Rosebud County flows toward the Musselshell River and subsequently into the Missouri River drainage to the north. The remainder of the drainage in Rosebud County is received by the Yellowstone River. The Yellowstone River flows northeast across Custer, Prairie, Dawson, and Richland Counties before joining the Missouri River near the Montana-North Dakota line northeast of Sidney.

The above streams provide a yearlong source of water for irrigation, livestock, and domestic needs. These streams have had, at various times, gaging stations installed by the United States Geological Survey where flow measurements are taken and recorded at regular intervals. Table 6 includes available data on the drainage area, discharge, and runoff for the gaging stations on the Yellowstone River at Huntley in Yellowstone County and at Miles City in Custer County. Also shown is the information for the gaging stations on the Tongue River at the Tongue River Dam near Decker in Big Horn County and at Miles City in Custer County. Included for reference is information on the gaging station on the Musselshell River at Musselshell in Musselshell County.

Many small reservoirs provide water storage for various uses in Rosebud County. Also, larger irrigation reservoirs such as the Tongue River irrigation reservoir, located on the Tongue River near Decker in Big Horn County, directly benefit the irrigation facilities within Rosebud County. The Montana Water Resources Board has published a list of information for all dams and reservoirs which store over fifty acre feet of water. Where the information was available, this list also includes data for privately owned dams and reservoirs. This information and other related irrigation facility information can be obtained from the Water Resources Board in Helena, Montana.

The climate does not have the extreme variable pattern common to the more mountainous western counties in Montana. Precipitation averages vary across the county with the highest averages being recorded at the higher elevations in southern Rosebud County. For instance, average annual precipitation at Colstrip and Lame Deer exceed fifteen inches. At Forsyth, annual precipitation is approximately fourteen

TABLE 6

STREAM GAGING STATIONS

Stream	Gaging Sta. Location	Drainage Area (sq mi)	See Notes	Discharge (cfs)					Years Averaged	Runoff-(1000 Acre-Ft)			
				Max.	Date	Min.	Date	Average		Max.	Date	Min.	Date
1. Yellowstone River	At Huntley in Yellowstone County	12,000	1	60,000	6/20/16	1,060	12/27/07	*	*	6,400	1908	5,280	1910
2. Tongue River	At Tongue River Dam near Decker in Big Horn County	1,770	1,2	7,340	6/15/67	0.5	4/17/40	435	29	554.0	1944	144.6	1940
3. Tongue River	At Miles City in Custer County	5,379	1,2	13,300	6/15/62	No Flow	Summer 1940	390	25	493.4	1947	119.0	1940
4. Yellowstone River	At Miles City	48,253	1,2	96,300	6/19/44	996	12/14/32	11,050	41	12,090	1943	4,229	1934
5. Musselshell River	At Musselshell in Musselshell County	4,568	1	9,850	6/19/67	No Flow	At Times	184	25	286	1948	38.6	1955

Source: U. S. Geological Survey Water Supply Papers and "Surface Water Records of Montana"

Notes: 1. Irrigation diversions occur above these stations

2. Flow is regulated by one or more reservoirs

* Not Recorded

inches, and at Ingomar and Rock Springs in extreme northern Rosebud County the averages are eleven and ten inches per year respectively. It is important to note, however, that the majority of the annual precipitation falls during the growing season of April through September.

In general, precipitation occurs as heavy rain in the spring months of April through June, intermittent showers throughout the summer and early fall months, and as snowfall during the winter months. The snowfall is generally light and does not tend to remain on the ground for long periods of time. Winter warming spells producing thawing temperatures throughout the county are not uncommon.

The use of surface water is widespread for domestic, agricultural, and recreational purposes. The town of Forsyth uses water from the Yellowstone River as a portion of its municipal supply. (See Table 7 for a chemical analysis of this water supply.) Agricultural uses of water are very important to the county, and the 1964 Census of Agriculture indicates that over 27,000 acres were being irrigated at that time. As is the case in most counties in eastern Montana, the potential exists for the irrigation of more acreage. A final but important use of surface water is for recreational purposes. The ponds, reservoirs, and streams in the county are ideal habitat for fish and waterfowl and draw many fishermen and hunters to the area each year.

Water Use Classifications

The Water Pollution Control Council has classified the streams and drainages in Montana according to the water use classification definitions shown in Appendix I. The streams and drainages of Rosebud County and surrounding areas are classified as follows:

Yellowstone River drainage from the Billings water supply intake to the North Dakota line except the tributaries listed below:	$B\text{-}D_3$
Pryor Creek drainage	$B\text{-}D_1$
Big Horn drainage above but excluding William's Coulee near Hardin	$B\text{-}D_1$
Big Horn drainage above but excluding William's Coulee to the Yellowstone River except the Little Big Horn listed below:	$B\text{-}D_2$

Little Big Horn drainage above and including Lodge Grass Creek near Lodge Grass	$B\text{-}D_1$
Remainder of the Little Big Horn drainage	$B\text{-}D_2$
Tongue River (mainstem) from Tongue River Reservoir to but excluding Prairie Dog Coulee	$B\text{-}D_2$
Remainder of the Tongue River drainage	$B\text{-}D_3$

TABLE 7

Chemical Analysis of Municipal Water Supplies (All Figures in Milligrams per Liter)*

City or Town	Forsyth	Birney	Birney
Source	Yellowstone River	Well	New Well
Date	6/67	7/61	1/62
Total Solids	326	2845	1020
Hardness	150	450	560
Ca	48	45	112
Mg	8	82	68
Na+K	63	869	147
CO_3	0	120	0
HCO_3	177	1068	531
SO_4	124	1185	403
Cl	8	18	12
NO_3	0.0	0.4	0.1
F	0.4	1.7	0.3
Fe	1.74	0.1	0.6
As	-	-	-
Pb	-	-	-
Cu	-	-	-
Zn	-	-	-

* See Appendix I, Table A, for accepted water quality standards

Source: State Department of Health, Helena, Montana

Ground-Water Resources

Ground water is widely used in Rosebud County for stock and domestic purposes. In many areas ground water is the only available source of water. Many residents of communities in Rosebud County obtain their water from private wells and springs; however, Birney, Lame Deer, and Ashland provide water to their residents from municipal wells. (See Table 7 for a chemical analysis of the Birney water supplies.) As of January 1970, 894 well and 342 spring appropriations were on file with the Montana Bureau of Mines and Geology for Rosebud County. A total of ninety one wells are reportedly used for domestic purposes, 580 for livestock, 177 for a combination domestic and livestock, nineteen for industrial purposes, seven for irrigation, and two for various other purposes. There are 132 springs reported for livestock, four for irrigation, three for domestic use, and four for a combination stock and domestic purpose; the use of 199 springs is not reported. There are a number of reports that describe geological conditions in parts of Rosebud County, and there is one report that describes the ground-water resources of southern and central Rosebud County. The ground-water report is Renick, B. B., 1929, Geological and ground-water resources of central and southern Rosebud County, Montana: U. S. G. S. Water Supply Paper 600.

The geological history of Rosebud County includes long periods of sedimentation and erosion and widespread deformation of the earth's crust. Structurally, the Porcupine Dome is in the northern part of Rosebud County. The Sumatra Syncline and Sumatra Anticline are in the northwestern part of the county, and the northern end of the county is part of the Powder River Basin. Erosion of the Porcupine Dome and Sumatra Anticline have exposed geological formations that are normally deeply buried. Similarly, the Sumatra Anticline and the Powder River Basin are areas in which the geological formations are more deeply buried beneath the ground surface.

Formations of importance to the ground-water resources of Rosebud County are the Eagle, Judith River, and Hell Creek Formations of Cretaceous age (65 to 135 million years old); the Fort Union Formation of Tertiary age (one to 65 million years old); and terrace deposits and alluvium of Quaternary age (less than one million years old).

The Eagle Formation is exposed over a broad area in northwestern Rosebud County. The water bearing characteristics of the Eagle are poorly known, but it yields small to moderate amounts of fair to poor quality water over much of central Montana. Very few wells are drilled into the Eagle in Rosebud County. Below the Eagle is a thick sequence of sedimentary rocks, some of which are water bearing. The depth of these formations and the probably poor quality of water has severely restricted development of ground water below the Eagle

Formation.

Overlying the Eagle Formation is about 475 feet of essentially non water bearing shales of the Claggett Formation. Above the Claggett is the Judith River Formation. Both the Claggett and Judith River Formations are exposed in outcrops that form a large ring in northwestern Rosebud County and underlie nearly the entire county. The Judith consists of about three hundred feet of sandstone and shale. The sandstone layers yield small to moderate quantities of fair to poor quality water. Water quality tends to become poorer away from the formation outcrops. Overlying the Judith is about one thousand feet of dark, marine shale that does not yield potable water. The formation is called the Bearpaw Shale, and it outcrops over a broad area in the northwestern part of the county.

Overlying the Bearpaw Shale is the Hell Creek Formation. The Hell Creek is about seven hundred feet thick and consists of interbedded shale and sandstone with a thick, massive sandstone base. Sandstones at the base of the Hell Creek may correlate with the Fox Hills Formation farther to the east. Sandstones of the Hell Creek furnish water to a number of wells. Yields are usually adequate for stock and domestic use, and water quality is fair to poor. The Hell Creek is exposed in a broad north south band that goes through the community of Forsyth.

Overlying the Hell Creek is the Fort Union Formation. The Fort Union is exposed over most of southern and eastern Rosebud County. The Fort Union in this part of Montana is divisible into the Tullock (lower or oldest), Lebo (middle), and Tongue River (uppermost or youngest) Members. The Fort Union attains a considerable thickness in southern Rosebud County and also thickens eastward from the central part of the county. The basal formation of the Fort Union, the Tullock Member, consists of about 150 to three hundred feet of light colored sandstone interbedded with shale, siltstone, and sandy shale. The Tullock should yield small quantities of fair to poor quality water to wells.

The Lebo Member consists of two hundred to three hundred feet of dark gray to light gray shale, sand, and sandstone. The Lebo is not a good aquifer but may supply small amounts of poor quality water to wells.

The Tongue River Member is present over a wide area in southern Rosebud County. The reported thickness of the Tongue River ranges from about fourteen hundred to seventeen hundred feet. The Tongue River consists of light gray to light yellow sandstone and shales and extensive coal beds. Sandstone and coal beds furnish water to numerous wells. The water is generally hard in shallow beds, is soft in the deeper beds, and is commonly under artesian conditions.

Along the Yellowstone River there are a number of terrace deposits that are up to 350 feet above the river. These terraces are composed of sand, gravel, silt, and clay, and where the deposits are sufficiently thick they will yield moderate to large quantities of water.

Unconsolidated alluvium ranging in thickness from a few feet to above forty feet is present along the major streams in the area and consists of unconsolidated silt, sand, clay, and gravel. Wells that are drilled into the thicker gravel and sand strata will produce moderate to large yields of poor quality water. Alluvial deposits along the Yellowstone and Tongue Rivers contain the best aquifers (water yielding material).

In summary, the Judith River Formation, the Tongue River Member of the Fort Union Formation, and Quaternary alluvium and terrace deposits are widely used as a source of water in Rosebud County. There will be continued development for stock and domestic purposes, and there may be some development of Quaternary deposits for irrigation and municipal purposes. Additional detailed studies are needed to assist in the development of Rosebud County's ground-water resources.

Sources:
1. M. K. Botz, Montana Bureau of Mines and Geology, Butte, Montana, 1970

2. State Department of Health, Helena, Montana

3. U. S. G. S. Water Supply Papers and "Surface Water Records of Montana"

4. "Water Resources Survey," Rosebud County, Montana, Montana Water Resources Board, Helena, Montana, 1948

5. Weather Bureau, Climatological Data, Montana Section, 1969

THE SOILS

General

General descriptions of soils in specific areas are useful in predicting the potential problems which might be encountered during private and public works construction. Rosebud County has an interesting and quite complicated geologic history which has greatly influenced the soil structure of the area. The predominate physiographic feature of the county is the braod Yellowstone River valley bordered by various levels of distinctive stream terraces.

The Yellowstone River valley has not been altered by glaciation, and over a long period of geologic time stream terraces consisting of clay, silt, sand, and gravel were developed as a result of a variation in the down cutting of the river channel. In addition to alluvial terraces, extensive drainage throughout the area over periods of time has resulted in the filling of many stream valleys with alluvium. The soils of Rosebud County are made up of the alterations of the alluvium and the sandstone, siltstone, and shale upland parent materials due to various conditions of climate, topography, and living organisms.

Soil Map

The Soil Conservation Service of the United States Department of Agriculture has prepared a preliminary general soil map for Rosebud County. The map as presented by them is shown in this report as Map 4. In developing this map, the Soil Conservation Service made field studies and observations which resulted in the designation of nine general soil areas. Each general soil area, as a rule, contains a few major and several minor soils. Soils within an area may differ greatly in short distances and any one soil may occur in more than one area. Thus, the general soil map does not show the kind of soil at any particular point but shows specific patterns of soils.

The Soil Conservation Service is continuing to expand the detailed soil study of Rosebud County. As additional information is gathered it will be available from the Soil Conservation Service office in Forsyth. Much of the detailed soil information gathered in the preparation of the general soil map is available at this time in the Forsyth office. It is recommended that all of the available soils information be consulted during the planning of proposed public works projects in Rosebud County. The services of the Soil Conservation Service soil scientists should be utilized for interpretive information concerning specific soil properties. Also, on site soil investigations should be performed.

The Soil Conservation Service preliminary draft descriptions of the nine soil areas shown on the general soil map are presented as follows:

1. These are rolling to steep upland soils, clay to clay loam in texture, and are ten to thirty six inches deep over shales and

sandstones. The larger drainages have terraces with clay loam to clay soils more than thirty six inches deep. These soils are used mainly for range land.

2. These are gently sloping to sloping, loam and clay loam soils, which are fifteen to thirty inches deep over sandstone. These soils are used mainly for nonirrigated crop land.

3. These are steeply sloping to rough uplands, with soils that range from loam to clay loam in texture that are less than thirty inches in depth over shales and sandstones. Soils on sloping fans and terraces are more than thirty inches deep and are loam and clay loam in texture. These soils are used mainly for range land.

4. These are sloping upland soils ranging in texture from sandy loam to sandy clay loam and are ten to twenty four inches deep over sandstone. These soils are used mainly for range land.

5. These soils occupy gently sloping terraces and range in texture from clay to clay loam and are more than twenty four inches deep over gravel and sands. These soils are used mainly for range land.

6. These soils occupy level stream terraces and range in texture from sandy loam to loam and clay loam and are more than twenty four inches deep over sands or gravel. These soils are used for irrigated crop land

7. These soils occupy gently sloping terraces and range in texture from loam to sandy loam or clay loam and are more than twenty four inches deep over sands or gravel. They are used for nonirrigated topland.

8. These soils occupy steep to rough uplands and consist of loam or clay loam soils ten to thirty inches deep over shales and sandstones. Broader fans and terraces contain deeper soils which are used for nonirrigated crop land, but the majority of land is used for range.

9. These soils occupy steep and rough uplands and are less than twenty four inches deep. These soils range from loam to clay loam in texture and are used for range land.

Conclusions

The soils of Rosebud County have generally been easy to deal with where domestic water wells and individual sewage drainfields have been constructed. The alluvium and other soil deposits have been found to be extremely variable in permeability, however. This has had an effect on both the quantity of water available in shallow domestic wells and the successful operation of individual sewage drainfields. In many areas extensive clay and silt deposits require special care in the construction and operation of septic tank drainfields.

Construction of municipal water and sewer systems in the various soils of Rosebud County should not be difficult. Pipeline trench digging in the sands and clays is extremely easy while the coarse gravels slow operations somewhat. Bedrock at shallow depths is not common in the valley bottoms; however, it can be expected at normal water and sewer line installation depths on benchlands above terraces adjacent to major drainages. Detailed soil information should be obtained before project planning and construction cost estimating are begun.

Source: U. S. Department of Agriculture, Soil Conservation
Service, Forsyth, Montana

COMMUNITY WATER SYSTEM FACILITIES

General

This comprehensive report covers the overall problems, existing or projected, for Rosebud County, Montana. The volume of data processed and evaluated and the intent of the report allow only a general analysis of any one system.

The intent of this report is to point out the general needs of each community with the objective that each community may in the future be provided with a safe and adequate water system. The general solutions to overall problems suggested in this report may have to be modified when detailed studies are made. These modifications may be in exact size of parts of a system or in some detailed design variation but will not detract from the overall value of the general information presented.

Basically, the demand for water from community systems is for domestic, fire fighting, and industrial uses. The demand for industrial water supply in small communities has not been extensive in Montana and in most cases will not control the design of community systems. Sufficient water for fire fighting must be considered; however, economic feasibility will usually control the extent of such facilities. In most small communities a system with sufficient capacity to give high ratings for fire protection would require facilities considerably larger than necessary for domestic purposes. The community might be unable to finance such an improvement; the approach, therefore, has been to propose a system suitable for present domestic needs. These basic facilities can be expanded for more complete service and for higher fire ratings as it becomes economically feasible.

The domestic use of water has increased greatly in recent years. This is partially due to improved economic conditions which make it possible for families to acquire such water consuming appliances as dishwashers, waste disposal units, and automatic washing machines. Water use for beautifying property has also increased. The most essential condition is adequate, safe, and potable water for domestic purposes, and this has been the primary consideration in this study. (See Appendix II for further comments on analysis criteria.)

Basic Considerations

Communities studied in this comprehensive plan were those with a minimum of five potential users and a maximum population of 5,500. Each community within this category was visited at least once. During these visits the type of water facilities available was examined, and an evaluation of the facilities was made from the standpoint of fulfilling the needs of the residents.

The existing systems were found to be quite varied in their operation, condition, and suitability for serving the needs of the users. The situation in each community was evaluated separately; however, some general classification of the various systems was possible. These are described briefly in the following paragraphs so that the general philosophy of the analysis can be shown.

1. In some communities the homes are quite widespread and few in number. Good water in adequate quantities can be found at reasonable depths, and for such situations private wells will provide a safe and suitable water system.

2. Many communities have had access to good water from private wells for many years. In some of these communities population is increasing, and the area is becoming more densely settled. As a result, tests for bacteriological quality of well water occasionally indicate that pollution is present. When this occurs, it is usually the beginning of a problem which will continue to worsen. Increasing population and a higher potential for contamination indicate the need for a safe community water facility. The system should be one which will serve the domestic needs of the present residents with provisions for improvements and expansion as needed.

3. Many communities have enjoyed a central water system for years but have not made annual improvements and replacements. This has resulted in overloaded and antiquated systems. Suggestions for immediate improvements which will fit into an overall replacement program are included in this report.

4. Some communities which have experienced a steady population growth are finding that their water systems are inadequate for present demands and will require enlargement. Population projections and economic trends are used to determine the need for improvements and also to justify the type and extent of proposed improvements.

Rosebud County

The estimated 1970 population of Rosebud County is 5,700. Approximately 3,375, or fifty nine percent of these people, are presently served by central water systems, and the remainder are served by such facilities as wells and springs. By 1980 about 4,010, or seventy seven percent of the population, will have access to central water systems if the schedule of proposed improvements is followed. It is expected that the remaining twenty three percent will live in outlying areas, and the homes will not be close enough together to make central systems feasible.

Forsyth

Existing System. The present population is estimated to be two thousand. Population projections indicate that the town will decrease in population throughout the planning period. The town is served by a central water system, and the layout is shown on Map 5.

Water supply is obtained from the Yellowstone River, and a complete water treatment plant is located at the northwest edge of town. This treatment plant has a capacity of 1.5 million gallons per day (gpd) which is adequate for the present and future needs of the town. The treatment plant was constructed many years ago and does need modernization in many respects. The plant does serve the present needs of the community; however, replacement and updating of equipment will be necessary during the planning period. The distribution system consists of four, six, and eight inch water mains, which distribute adequate quantities of water throughout the community. The distribution system is in good condition and adequately serves the needs of the community. Storage presently consists of a 330,000 gallon storage tank located on high ground to the south of town. This storage facility has adequate capacity for the present and future needs of the town. The community has considered additional storage near the east edge of town in order that pressures can be increased in that area.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 1,950. During this period it is proposed that additional storage be developed as shown on Map 5. This storage will tend to increase pressures at the east edge of the system and will provide additional storage for periods of high demand. As previously mentioned, the existing water treatment plant is very old and does need modernization throughout. The structure is basically sound; however, the water conditioning equipment should be replaced during the planning period. It is proposed that a program be established; whereby a portion of the equipment is replaced periodically. Since this is the community's only water supply, it is important that the facility be reliable. Minor repair and replacement will be necessary throughout the distribution system.

Improvements by 1990. For 1990 the population is expected to be seventeen hundred. The existing system together with the improvements proposed under the five to ten year plan will result in a facility which is adequate for the needs of the 1990 population. It is expected that the water treatment plant will be completely modernized during this period. Minor repair and replacement will continue to be necessary throughout the distribution system.

Lame Deer

Existing System. The 1970 population is estimated to be eleven hundred. Population projections indicate that the town will show substantial increase throughout the planning period. The town is served by a central water system, and the layout is shown on Map 6.

Water supply is obtained from two wells with a combined capacity of 220 gallons per minute (gpm). This is not an adequate supply of water for the present population, and additional wells will be necessary. A six inch supply line and a four inch supply line connect the wells with the distribution system. These supply lines have adequate capacity for the present demands. The distribution systems consists of four, six, and eight inch water mains which provide adequate flows and pressures throughout most parts of the system. Many of the distribution mains are old; however, they are reportedly in good condition. Storage presently consists of a 200,000 gallon tank. This is an adequate amount of storage for the present and future needs of the town.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 1,150. Additional water supply will be necessary during this period. Two wells with a combined capacity of 420 gpm should be developed. This will result in an adequate supply of water being available for the needs of the community throughout the entire planning period. Expansion of the distribution system into new areas of development will also be necessary. This expansion program should involve the larger diameter water mains presently in existence in the distribution system. Repair and replacement will be required to keep the system in satisfactory operating condition.

Improvements by 1990. For 1990 the population is expected to be fourteen hundred. The existing system together with the improvements proposed under the five to ten year plan will result in a facility with adequate capacity for the needs of this population. Expansion of the distribution system into new areas of development will continue to be necessary; however, the system has sufficient capacity for this expansion. Additional elevated storage may be necessary during this period, and it is possible to construct a second storage tank on high ground in the community. Repair and replacement of the distribution system will be necessary.

Ashland

Existing System. The estimated 1970 population is four hundred. This includes the area shown on Map 7 and does not include the St. Labre Mission located north of the Tongue River. There is a partial community water system located as shown on Map 7 which serves several homes in that area. The St. Labre Mission also has an existing water system. The town of Ashland presently obtains its water supply from private wells. These wells are about three hundred feet in depth at the townsite, but some wells near the river are only twenty to thirty feet deep. The deeper wells produce adequate quantities of fair quality water. There is soda present, and a taste and odor are associated with the water. A community water system facility is feasible for the present and future populations of this town, and it is proposed that it be constructed in the near future.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 450. A community water system facility is proposed for construction during this period, and the layout of the system is shown on Map 7. A water supply with a capacity of 250 gpm can be developed in the area. An infiltration gallery near the Tongue River or a deep well could be used. Water quality would be the determining factor in which supply would be developed. Storage with a capacity of 100,000 gallons could be located on the high ground as shown on Map 7. The distribution system should provide service to each residence and commercial development in the community. It is proposed that the existing water system near the west edge of town be connected to the proposed Ashland system.

Improvements by 1990. For 1990 the population is expected to be six hundred. The system as proposed under the five to ten year plan will have sufficient capacity for the needs of this population. Only minor repair and replacement will be necessary to keep the system in satisfactory operating condition. Expansion of the distribution system into new areas of development is the only major improvement anticipated.

Rosebud

Existing System. The one hundred persons who presently reside in this community obtain their water supply from private wells. These wells range in depth from twenty five to three hundred feet deep and produce adequate quantities of fairly good quality water. Many of the deeper wells produce artesian flows and are associated with the poorer quality water found in the community. A community water system is feasible for the present population of the community, and it is proposed that it be constructed in the near future.

Improvements Next Five to Ten Years. For 1975 the population is expected to be eighty five. A community water system is proposed as shown on Map 8. Water supply with a capacity of fifty six gpm can be obtained in the area and would provide adequate water for the present and future needs of the town. A storage facility with a capacity of forty thousand gallons could be constructed on high ground to the south of town. The proposed system will adequately serve the needs of the community throughout the planning period.

Improvements by 1990. For 1990 the population is expected to be fifty. A portion of this population decrease can be attributed to the present lack of adequate sanitary facilities. The system as proposed under the five to ten year plan will adequately serve the needs throughout the entire planning period. Only minor repair and replacement will be necessary to keep the system operating satisfactorily.

Ingomar

Existing System. The sixty persons who presently reside in this community obtain their water supply from a central cistern located in the community. Water is hauled from Harlowton or Melstone via railroad tank car and deposited in the cistern located in the community. Residents then carry water to their homes for private use. Wells are not available in the community, and therefore, it is necessary to haul all water which is used for domestic purposes. This method of obtaining water supply is satisfactory; however, it is very inconvenient. It is feasible to install pumping facilities and distribution piping to carry water to each household.

Improvements Next Five to Ten Years. For 1975 the population is expected to be fifty five. During this period it is proposed that an underground storage reservoir with a capacity of forty thousand gallons be developed. It is proposed that water be hauled on the railroad as is presently done to keep this reservoir full. Constant pressure pumping facilities should be installed to force the water from the cistern to each of the homes. A distribution system consisting of small diameter lines could be constructed to carry water to each household.

Improvements by 1990.

For 1990 the population is expected to be forty. The system as proposed under the five to ten year plan will have sufficient capacity for the needs throughout the entire planning period. Only minor repair and replacement will be required to keep the system in satisfactory operating condition.

Birney Day Village

Existing System. The one hundred persons who presently reside in this community have access to a community water system. The layout is shown on Map 10.

A well with a capacity of fifteen gpm presently supplies the system. Storage facilities consist of a fifteen thousand gallon elevated storage tank. The system has adequate capacity for the present number of persons who are connected to the system. Actually only a small number of homes derive their water supply from the distribution system.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 110. During this period it is proposed that a second well with a capacity of forty five gpm be developed. This will provide an adequate supply of water for the present and future demands of the community. Minor repair and replacement will also be necessary to keep the system in satisfactory operating condition.

Improvements by 1990. For 1990 the population is expected to be 150. The existing system together with the improvements proposed under the five to ten year plan will provide a system with adequate capacity for the needs of the 1990 population. Only minor repair and replacement will be required to keep the system in satisfactory operating condition.

Birney

Existing System. The fifteen persons who presently reside in this community obtain their water supply from private wells. These wells are about 450 feet deep and produce an adequate quantity of fair quality water. The water has a high soda content and taste and odor are present. These wells do produce an adequate water supply, however.

Improvements by 1990. For 1990 the population is expected to be five. The present use of private wells will continue to be the most suitable water supply for the residents of this community throughout the entire planning period. These systems do produce suitable water in adequate quantities for the needs of each household.

COMMUNITY SEWER SYSTEM FACILITIES

General

Each use of water adds some material or alters some characteristic enough to change the original quality of the water and often to pollute it. The transportation and dilution of municipal, industrial, and agricultural wastes are important and necessary uses of water; therefore, special emphasis is placed on the control of water pollution from these sources. Some of these wastes can be carried in limited amounts without damage to the resource. Some wastes if discharged into water courses can make their way into underground aquifers and pollute the ground water so that it is unsuitable for further use.

Pollution by definition and interpretation is a matter of degree. Since it is inevitable that the quality of water will be altered with each use, it is of critical importance to control the degree of pollution.

It is public policy established by the state legislature to maintain reasonable standards of purity for the water of the state. These standards are to be consistent with the use of these waters, including their use in carrying away the water borne waste products of society. The current Federal Water Pollution Control Act in reference to pollution abatement gives the individual states discretion in assessing the physical and economic feasibility of complying with water quality standards. The "Water Quality Criteria," "Water Use

Classifications," and "Policy Statements" of the Montana Water Pollution Control Council for streams and rivers in Montana have been included in Appendix I.

Sewage may be broadly categorized as domestic or municipal waste, industrial waste, and animal or agricultural waste. Animal wastes are usually not involved in community sewage facilities; however, they do constitute a potential source of pollution which must be controlled and prevented from entering streams or other potential water supplies.

Although industrial activity throughout Montana has been limited, the need for control and treatment of industrial wastes is apparent. Industrial wastes vary in quantity and composition as greatly as the products and processes which generate them. They include toxic chemicals, solids carried in suspension, brines, strong acids and alkalies, oils, dyes, floating solids, and the heat generated by industrial processes. Industrial wastes are not found to be a major factor in the design of most community sewage facilities. Where economic projections indicate industrial development, the relationship to loading on domestic sewer systems is considered.

Domestic sewage is the primary consideration of this study and has been the basis for design and analysis. Where particular systems are subjected to loading from industrial sources, a more detailed study will be necessary. The general approaches outlined in "Analysis Criteria" in Appendix III will suffice in practically all cases.

Basic Considerations

There are generally three main methods of sewage disposal. These are septic tanks, mechanical sewage treatment plants, and wastewater stabilization ponds. Local soil conditions, availability of land, and density of population are the basic factors which govern the selection of a particular method.

Many of the smaller communities have relied on individual septic tanks and cesspools for each home to handle sewage disposal. Septic tanks are suitable if the population density is low and if the systems are properly designed and maintained. Overflow from these tanks must drain into the soil and, depending on local soil conditions, may or may not create a problem. There is a limit to the amount of water that even loose granular soil can absorb. Density of population and the length of time the effluent has been entering the soil are factors which indicate whether septic tanks can be suitable for sewage disposal.

When economically feasible, community sewage collection and disposal systems are much more desirable than individual systems. Community systems eliminate the worry of septic tank failure, the danger of well contamination, and the problem of soil saturation. However, it is usually uneconomical to serve a few homes scattered over a large area with a community sewer system.

The type of sewage disposal facilities to be used can generally be determined on the basis of economic factors. Mechanical treatment plants provide an excellent means of sewage disposal although the initial cost, maintenance cost, and power cost are usually high. Wastewater stabilization ponds are an ideal method of sewage disposal and usually are the most economical to construct and maintain.

The Montana Water Pollution Control Council has established the criteria that treatment of domestic and industrial wastes shall be secondary treatment or its equivalent. For domestic sewage, mechanical treatment plants or stabilization ponds, when either is properly designed, constructed, and operated, meet these requirements.

A schedule for completion of secondary treatment facilities by communities across the state has been established by the State Department of Health. The target date is included for individual towns when applicable.

Rosebud County

Approximately 3,275, or fifty eight percent of the Rosebud County population, are presently served by community sewer facilities. By 1990 about four thousand, or eighty three percent of the population, will have access to community facilities if the proposed expansion program is followed. The remaining seventeen percent will live in outlying areas, and the homes will not be close enough together to make community systems feasible.

Forsyth

Existing System. The present population is estimated to be two thousand. A community sewer system is in existence, and the system layout is shown on Map 12.

A collection system, consisting of six, eight, ten, twelve, and fifteen inch sewer mains, picks up sewage from throughout the community and carries it to a collection point near the east edge of town. This collection system is reportedly in good condition and has adequate capacity for the present and future sewage flows. Sewer service is provided to all homes in the immediate area of the town. At the collection point a lift station is necessary to force the sewage on to the treatment facilities. An eight inch force main continues on from the lift station towards the treatment facilities. This force main then discharges into a twelve inch outfall line before the treatment facilities are reached. The lift station, force main, and twelve inch outfall line have adequate capacity for the present and future needs of the community. Sewage treatment is presently handled by a 7.47 acre wastewater stabilization pond. This treatment facility is presently undersized according to modern design standards. It will be necessary to expand the treatment facility in the near future.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 1,950. The existing collection system has adequate capacity for the anticipated sewage flows from this population. Minor repair and replacement of certain lines will be necessary to keep the system operating satisfactorily. During this period it is proposed that a twelve acre addition be made to the wastewater stabilization pond. The community is aware that this expansion will be necessary and plans to enlarge the facility in the near future.

Improvements by 1990. By 1990 the population is expected to be seventeen hundred. The existing system together with the improvements proposed under the five to ten year plan will result in an adequate sewer system for the needs throughout the entire planning period. Minor repair and replacement are the only improvements which will be required to keep the system in satisfactory operating condition.

Lame Deer

Existing System. The estimated 1970 population is eleven hundred. A community sewer system is presently in existence, and the layout is shown on Map 13.

A collection system, consisting of six, eight, and ten inch sewer mains, picks up sewage throughout the community and carries it to a collection point near the north edge of town. This collection system provides sewer service to all areas of the community and has adequate capacity for the present and anticipated future flows. The lines are reportedly in good condition; however, maintenance will be required to keep the system operating satisfactorily. Sewage disposal is presently handled by a five acre wastewater stabilization pond. This treatment facility is not large enough for the present population and will have to be expanded in the near future.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 1,150. During this period it is proposed that a ten acre addition be made to the wastewater stabilization pond. This improvement will result in adequate treatment facilities for the needs throughout the entire planning period. Expansion of the collection system into new areas of development will also be necessary; however, the existing collection system has sufficient capacity for this.

Improvements by 1990. For 1990 the population is expected to be fourteen hundred. The existing system together with the improvements proposed under the five to ten year plan will result in a facility adequate for the needs of this population. Minor repair and replacement are the only improvements necessary to keep the system in satisfactory operating condition. Expansion of the collection system will continue to be necessary during this period.

Ashland

Existing System. The four hundred persons who presently reside in this community rely on private septic tanks, cesspools, and outhouses for sanitary facilities. The soil in the area is a clay loam material; however, major operational problems are not experienced. These systems reportedly operate satisfactorily. There is sufficient population here to make a central sewer system feasible, and it is proposed that it be constructed in the near future. A small portion of the town has a central sewer system as shown on Map 14. This facility operates satisfactorily.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 450. A community sewer system is feasible, and it is proposed that it be constructed during this period. A layout of the proposed system is shown on Map 14.

A collection system which would provide sewer service to all areas of the community which are presently developed is proposed. A collection point near the Tongue River north of town is proposed. At this point a lift station will be required to force the sewage on to the treatment facilities. A six inch force main from the collection point to the treatment facilities will be necessary. A six acre wastewater stabilization pond is proposed for sewage treatment and will have adequate capacity for the 1990 population. It is proposed that the small central sewer system presently in existence near the west edge of town be tied into the proposed sewer system for the remainder of the community.

Improvements by 1990. For 1990 the population is expected to be six hundred. The system as proposed under the five to ten year plan will have adequate capacity for the needs throughout the entire planning period. Minor repair and replacement will be necessary to keep the system in satisfactory operating condition. It will be necessary to extend the collection system to new areas of development, and the proposed system has sufficient capacity to do this.

Rosebud

Existing System. The one hundred persons who presently reside in this community rely on private septic tanks and cesspools for sewage disposal. The soil in the area is a clay material; however, major operational problems are not experienced. The systems reportedly function satisfactorily and do provide adequate sewage disposal. The population density is sufficient for the construction of a community sewer system facility. It is proposed that this system be constructed in the near future.

Improvements Next Five to Ten Years. For 1975 the population is expected to be eighty five. It is proposed that a community sewer system be developed as shown on Map 15.

A collection system extending service to all areas of the community is proposed. At the collection point near the northeast edge of town a lift station will be necessary to force the sewage on to the treament facilities. A four inch force main is recommended to carry the sewage flows. Sewage disposal can be handled by a one acre wastewater stabilization pond.

Improvements by 1990. For 1990 the population is expected to decline to fifty. A portion of this decrease can be attributed to the present lack of central sanitary facilities. The system as proposed under the five to ten year plan will have sufficient capacity for the needs of the 1990 population. Only minor repair and replacement will be required to keep the system in satisfactory operating condition.

Ingomar

Existing System. The sixty persons who presently reside in this community rely on private septic tanks for sewage disposal. The soil in the area is primarily a clay material and many operational problems are present. Properly constructed and maintained systems do provide adequate sewage disposal.

Improvements by 1990. For 1990 the population is expected to be forty. Throughout the entire planning period the present use of private septic tanks will continue to be the most suitable means for handling sewage disposal. Properly constructed and maintained systems do provide adequate sewage disposal.

Birney Day Village

Existing System. The one hundred persons who presently reside in this community rely on private septic tanks, cesspools, or outhouses for sewage disposal. The soil in the area is primarily a clay loam material and does not present major operational problems. There is sufficient population residing here to make a community sewer system feasible.

Improvements Next Five to Ten Years. For 1975 the population is expected to be 110. A community sewer system facility is proposed as shown on Map 16.

A collection system extending service to all areas of the community is proposed. At the collection point near the northeast edge of town, a lift station will be necessary to force the sewage on to the treatment facilities. A 1.5 acre wastewater stabilization pond is proposed for sewage disposal.

Improvements by 1990. For 1990 the population is expected to be 150. The system as proposed under the five to ten year plan will have sufficient capacity for the needs of the 1990 population. Only minor repair and replacement will be necessary to keep the system in satisfactory operating condition.

Birney

Existing System. The fifteen persons who presently reside in this community rely on private septic tanks for sewage disposal. The soil in the area is a clay material with gravel and sand underlying it. Major operational problems are not experienced with these systems, and they do provide adequate sewage treatment.

Improvements by 1990. For 1990 the population is expected to be five. Throughout the entire planning period the present use of private septic tanks will continue to provide adequate sewage treatment.

PREFACE TO MAPS

The following maps have been prepared from several sources. The county maps were prepared from Transverse Mercator Projection Series Maps and Montana Highway Department Maps, Planning and Survey Series. The reduction of the county maps necessary for this publication makes them useful for general reference purposes only.

The town and community base maps used herein are taken from Montana State Highway Commission City and Town Plats prepared from aerial photographs dated 1961 to 1969 and have been updated where necessary. On-site surveys, plats obtained from individual towns, and aerial photography conducted in 1970 were also used. Uncontrolled mosaics have been used and scales are, accordingly, only approximate and are shown for referencing purposes only. The mapping operation was supplemented by field checks made during 1970.

Land use information was obtained by field surveys, supplemented and checked by aerial photography during 1969 and 1970.

Water and sewer systems maps show existing facilities for individual towns and communities except where the information was not available. Data concerning these community facilities was obtained from the records of the individual communities and of the State Department of Health. Water and sewer lines are shown in the center of streets to indicate the existence of lines rather than precise locations. The sizes of lines, obtained from the most current information available, are indicated when possible. The locations of recommended improvements are given as relative locations and are not meant to be scaled from the individual town or community maps.

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BIRNEY DAY VILLAGE SEWER SYSTEM	16

MAP I

COUNTY MAP
GENERAL RELIEF

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

——— ROADS-HIGHWAYS
STATE HIGHWAY U. S. HIGHWAY

- - - - RAILROADS

~ STREAMS-LAKES

—·—·— COUNTY BOUNDARY

┅ INDIAN RESERVATION

□ 0-3,000 FT. ELEVATION

░ 3-5,000 FT. ELEVATION

▒ 5-7,000 FT. ELEVATION

▓ OVER 7,000 FT. ELEVATION

MAP 2

LEGEND

MAJOR STATE-WIDE COVERAGE

POWER AND GAS SYSTEMS

□ POWER PLANT (IN MEGAWATTS)
---- 1 to 50 KILOVOLTS
—— 51 to 100 KILOVOLTS
-··—··- 101+ KILOVOLTS
········· PROPOSED LINES
-•-•- GAS LINES

RECREATION AREAS

1. LOST CREEK STATE PARK
2. LEWIS AND CLARK CAVERNS STATE PARK
3. LAKE MARY RONAN STATE PARK
4. MEDICINE ROCKS STATE PARK
5. ROSEBUD STATE PARK
6. ROCK CREEK STATE PARK
7. MAKOSHIKA STATE PARK
8. WEST SHORE STATE PARK
9. WOODS BAY STATE PARK
10. BITTERROOT LAKE STATE PARK
11. ASHLEY LAKE STATE PARK
12. LONE PINE STATE PARK
13. JAMES KIPP STATE PARK
14. HOOPER MEMORIAL STATE PARK
15. HELL CREEK STATE PARK
16. FINLEY POINT STATE PARK
17. ELMO STATE PARK
18. FLATHEAD LAKE STATE PARK
19. YELLOW BAY STATE PARK
20. WALSTAD MEMORIAL PARK
21. THOMPSON FALLS STATE PARK
22. WHITEFISH LAKE STATE PARK
23. WAYFARERS RECREATION AREA
24. TIBER RESERVOIR RECREATION AREA
25. CLARK CANYON RESERVOIR RECREATION AREA
26. ENNIS RECREATION AREA
27. DEADMAN'S BASIN RESERVOIR RECREATION AREA
28. PAINTED ROCKS RESERVOIR RECREATION AREA
29. CANYON FERRY RECREATION AREA
30. LOGAN PARK RECREATION AREA
31. NELSON RESERVOIR RECREATION AREA
32. BEAVERTAIL HILL RECREATION AREA
33. GLACIER NATIONAL PARK
34. YELLOWSTONE NATIONAL PARK

▨ NATIONAL FORESTS

MAP 3

COUNTY MAP
LAND OWNERSHIP

LEGEND

● CITIES-TOWNS

○ COUNTY SEAT

ROADS-HIGHWAYS
—— STATE HIGHWAY U. S. HIGHWAY

— — — RAILROADS

🟦 STREAMS-LAKES

—·—·— COUNTY BOUNDARY

▒ INDIAN RESERVATION

▭ PRIVATELY OWNED LAND

▬ STATE OWNED LAND

▭ FEDERAL OWNED LAND

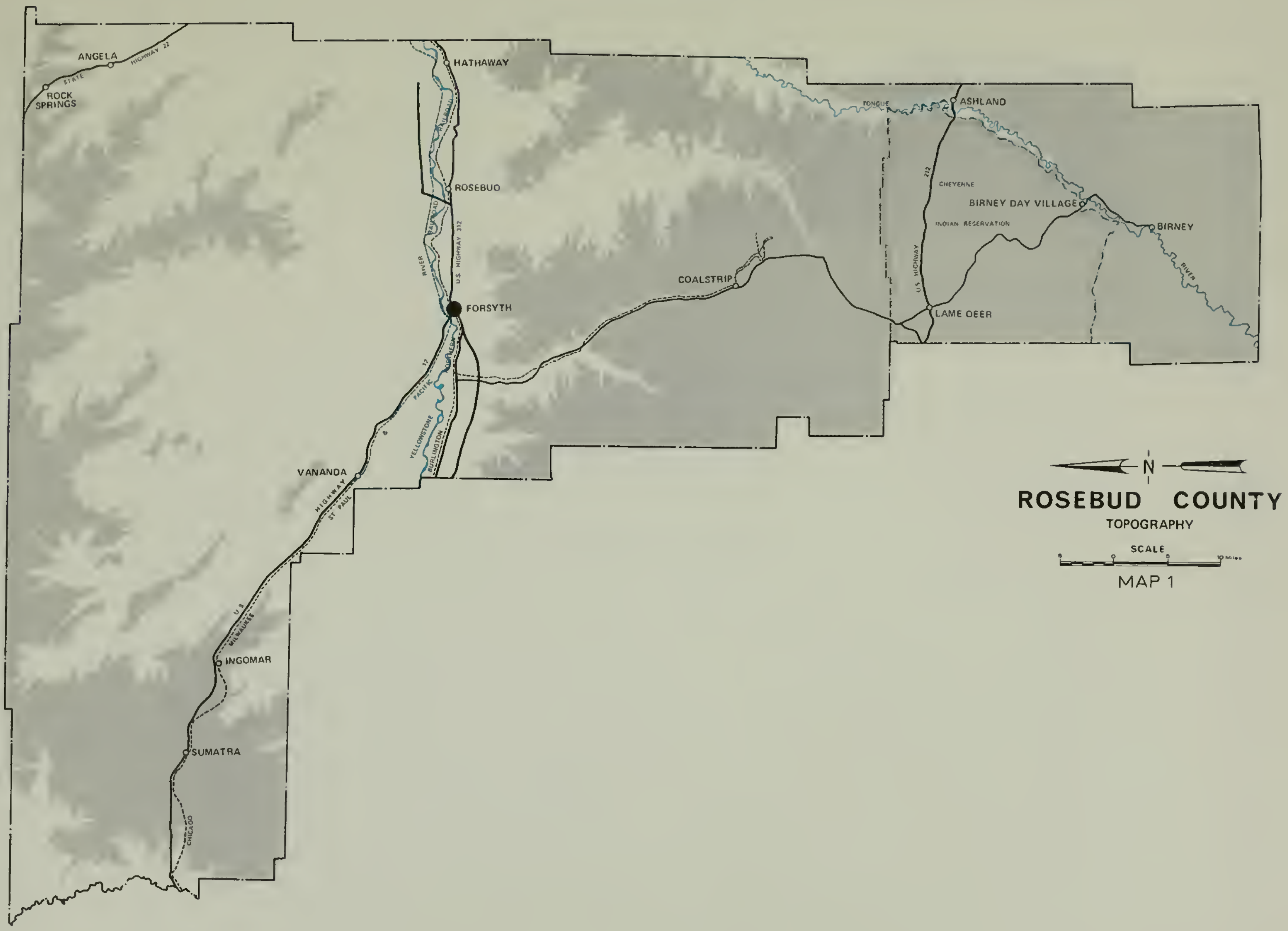
CITIES MAP LEGEND

LAND USE

●	SINGLE RESIDENCE
◒	DILAPIDATED RESIDENCE
Ⓣ	SINGLE TRAILER RESIDENCE
⊕	MULTIPLE RESIDENCE
○	APARTMENTS
🅃	TRAILER COURT
■	COMMERCIAL BUILDING
◪	HOTEL-MOTEL
△	PUBLIC BUILDING
Ⓢ	SCHOOL
⬢	CHURCH
⊞	HOSPITAL
✹	INDUSTRIAL
🅴	GRAIN ELEVATOR

WATER and SEWER SYSTEMS

—6—	EXISTING LINES AND SIZES
- - - -	PROPOSED LINES 5-10 YEAR
┈┈┈┈	PROPOSED LINES 10-20 YEAR
—◀—	EXISTING LIFT STATION
- -◁- -	PROPOSED LIFT STATION
●	EXISTING WATER STORAGE TANK
¤	PROPOSED WATER STORAGE TANK
—⊡	EXISTING WATER SOURCE
- -⊡	PROPOSED WATER SOURCE
—☐	EXISTING TREATMENT FACILITIES
- -☐	PROPOSED TREATMENT FACILITIES
░	SERVICE AREA 1970-1980
▒	SERVICE AREA BY 1990



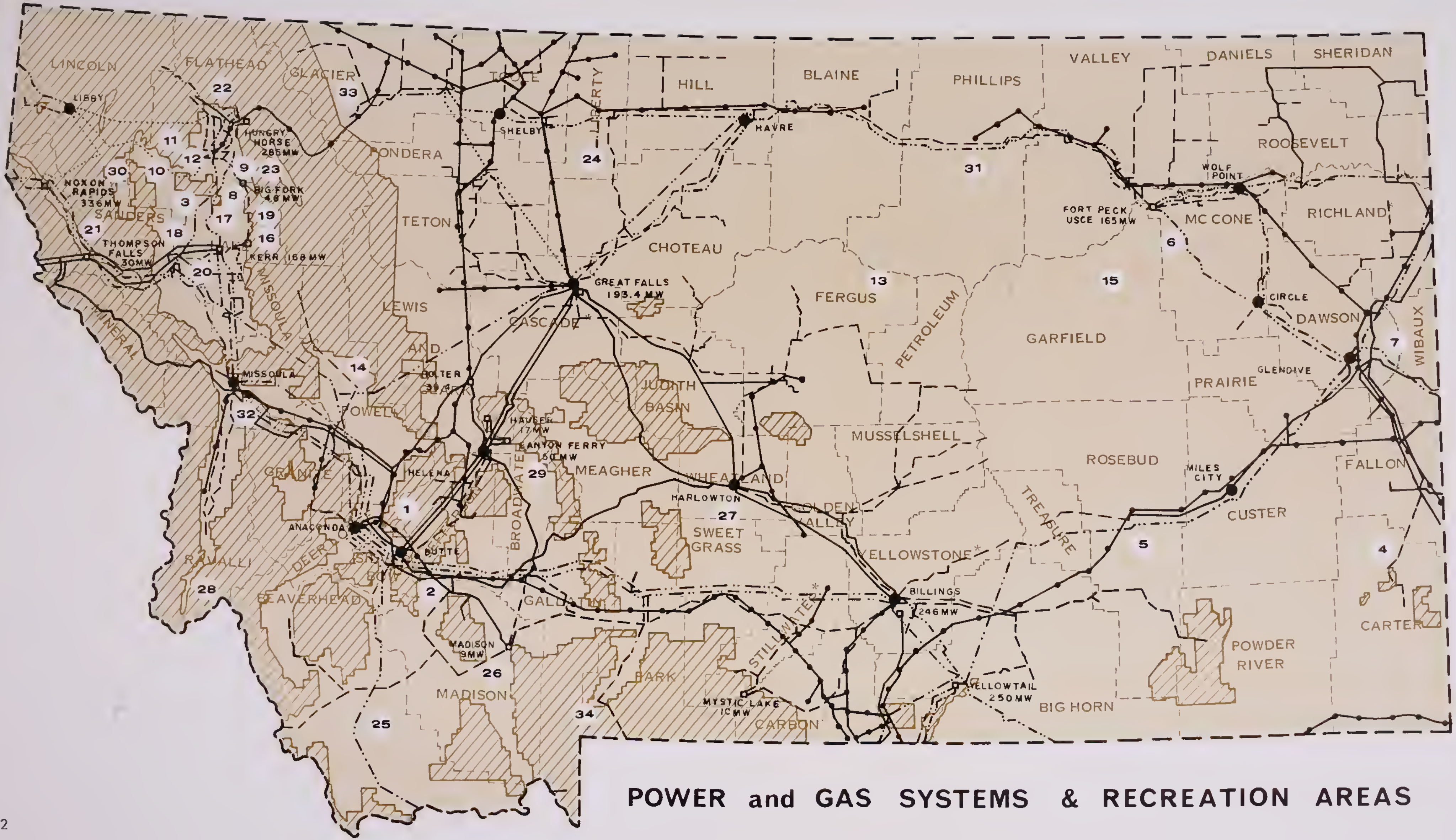
ROSEBUD COUNTY

TOPOGRAPHY

MAP 1

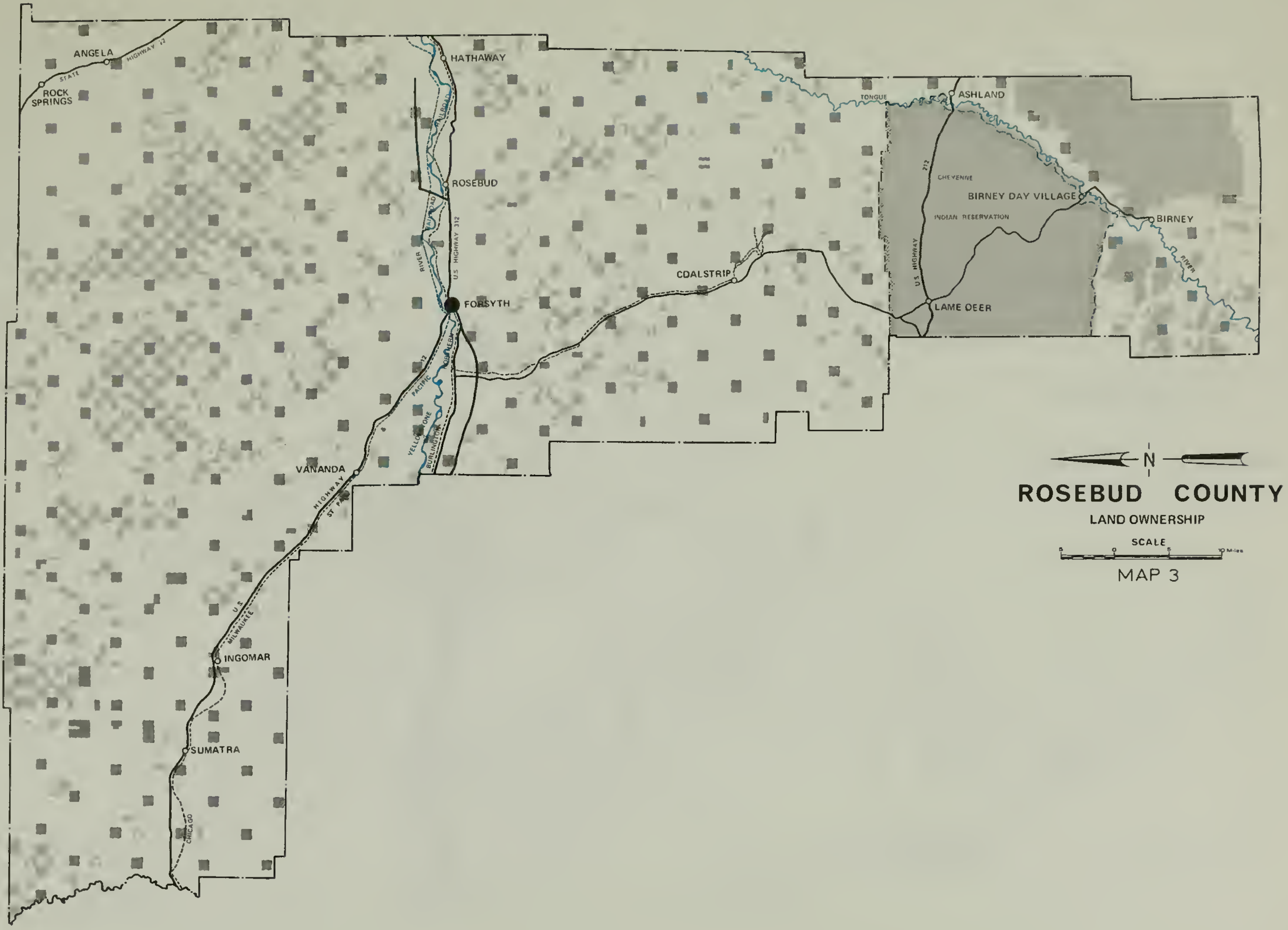
JNTY
LINCOLN
LIBBY
30
NOXON
RAPIDS
336MW
SANDE
21
THOMPS
FALLS
30MW
INERAL

MAP 2



POWER and GAS SYSTEMS & RECREATION AREAS

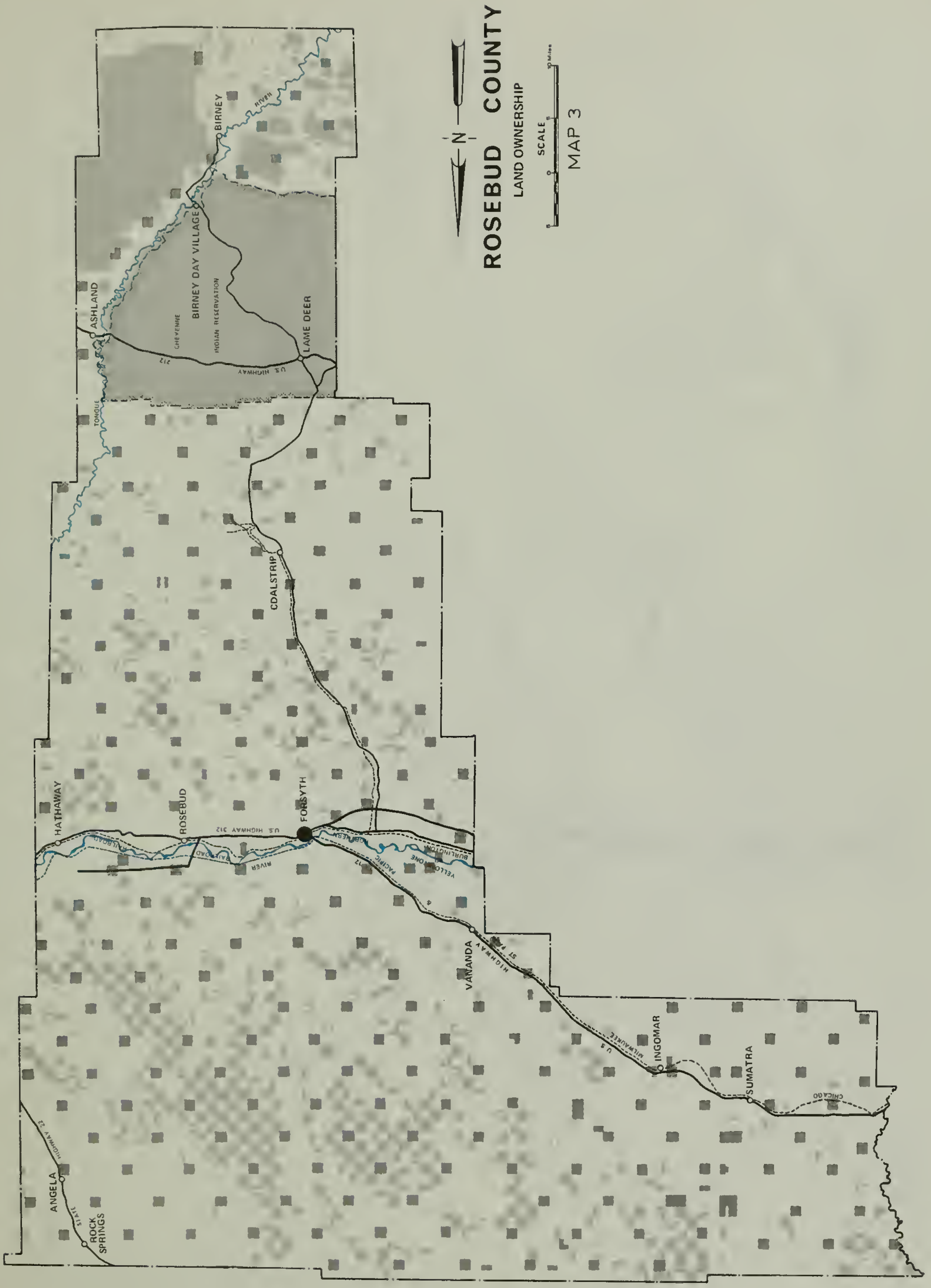
MAP 2



ROSEBUD COUNTY

LAND OWNERSHIP

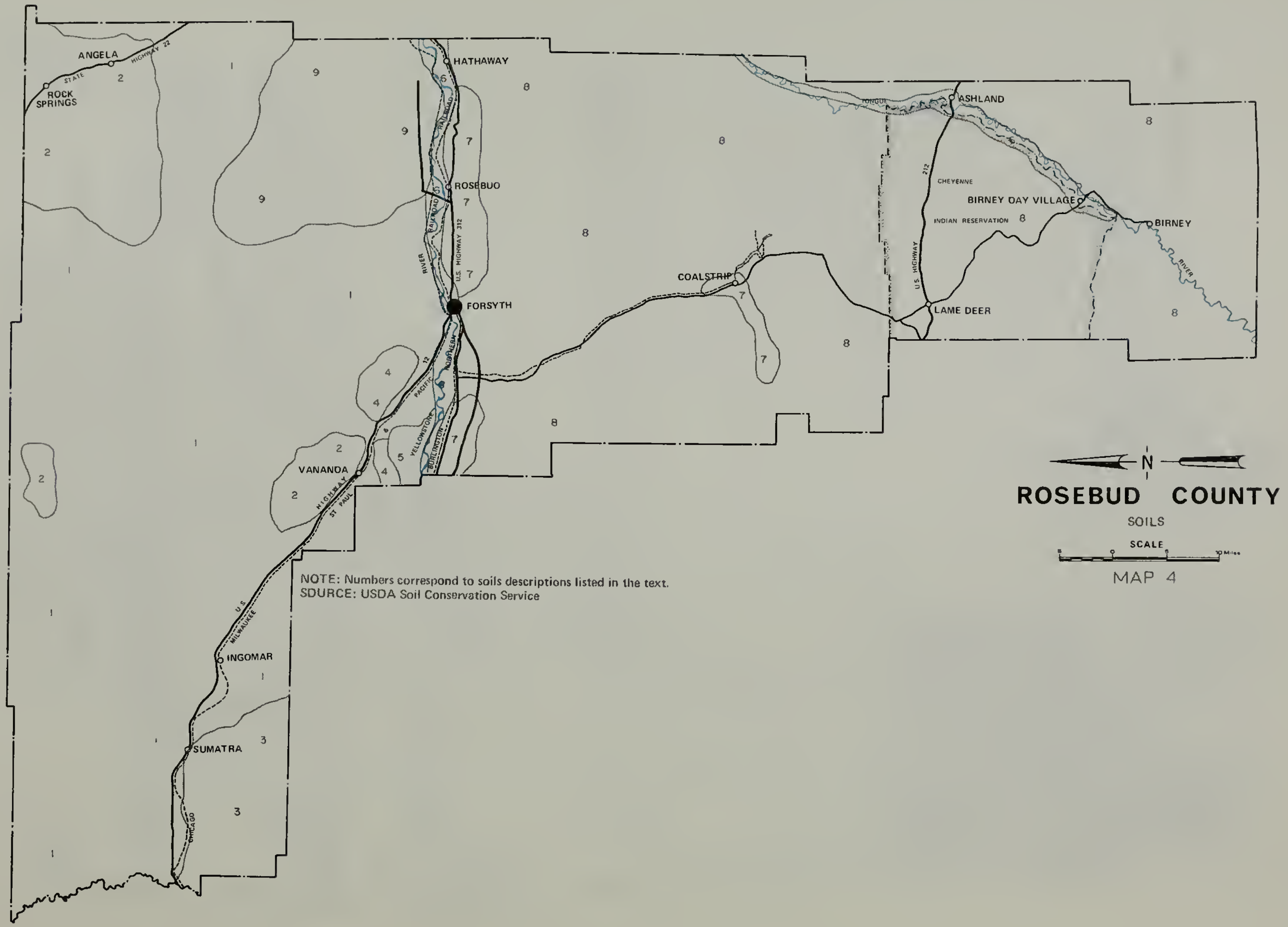
MAP 3



ROSEBUD COUNTY

LAND OWNERSHIP

MAP 3

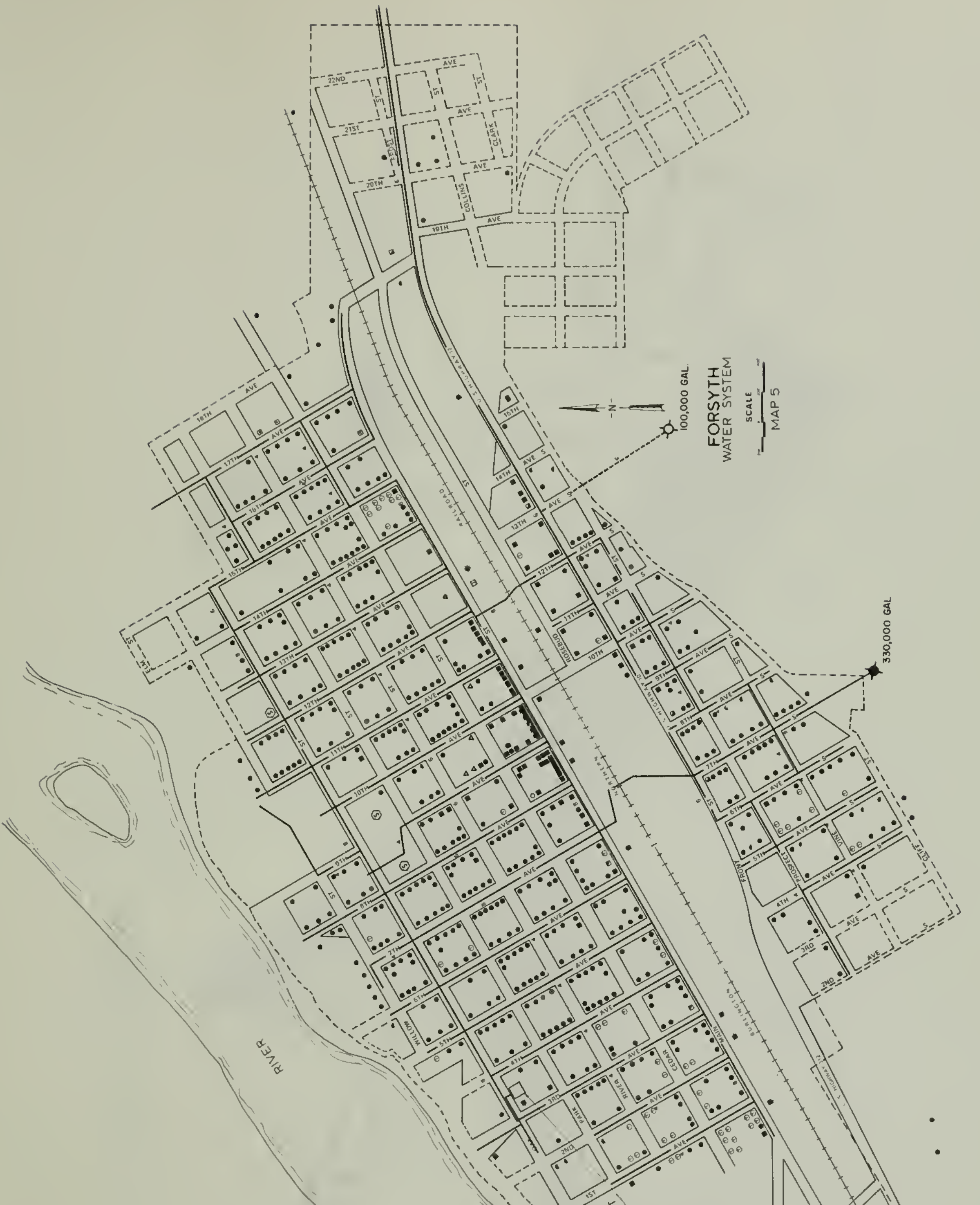


ROSEBUD COUNTY

SOILS

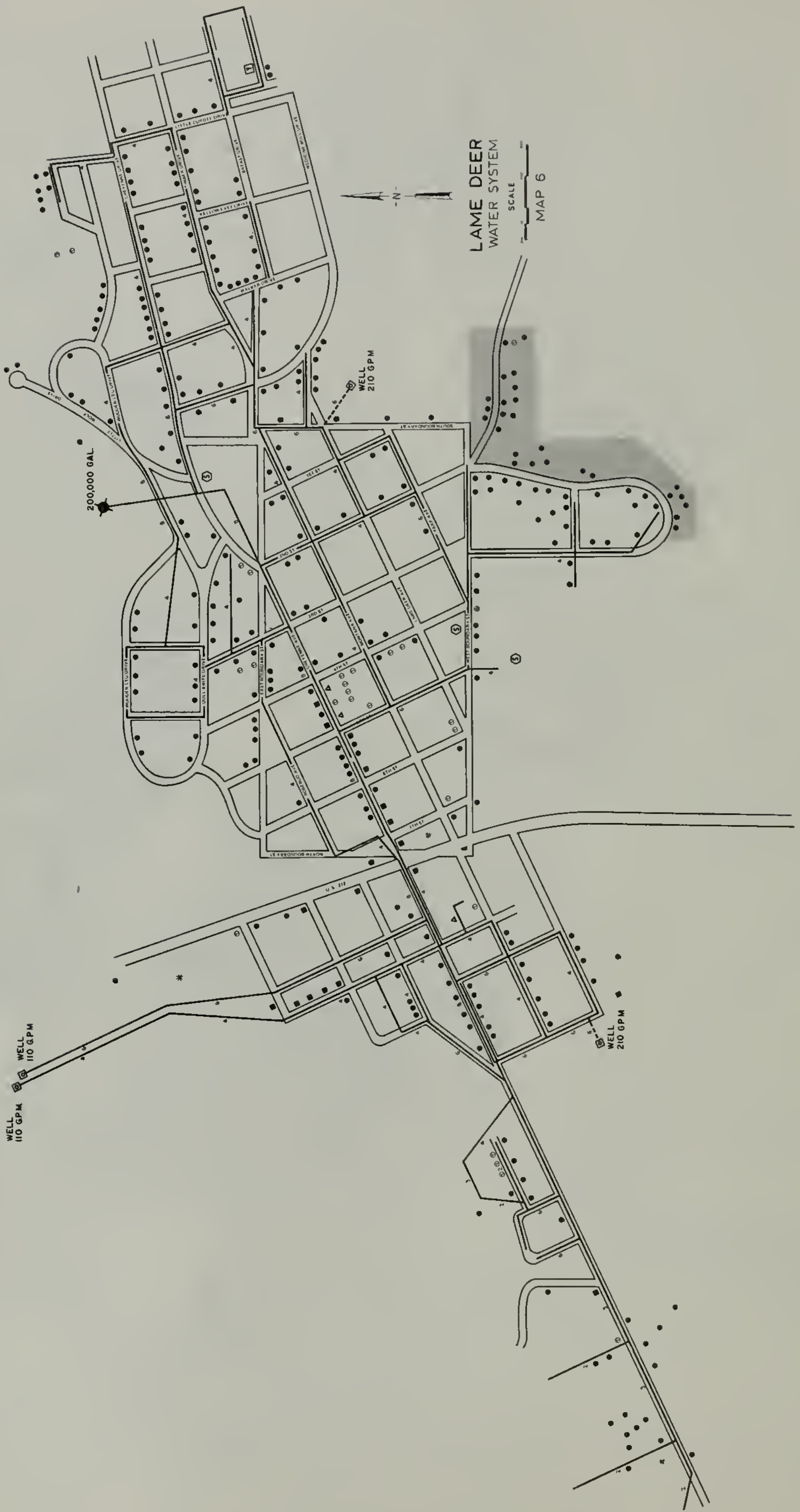
MAP 4

NOTE: Numbers correspond to soils descriptions listed in the text.
SOURCE: USDA Soil Conservation Service

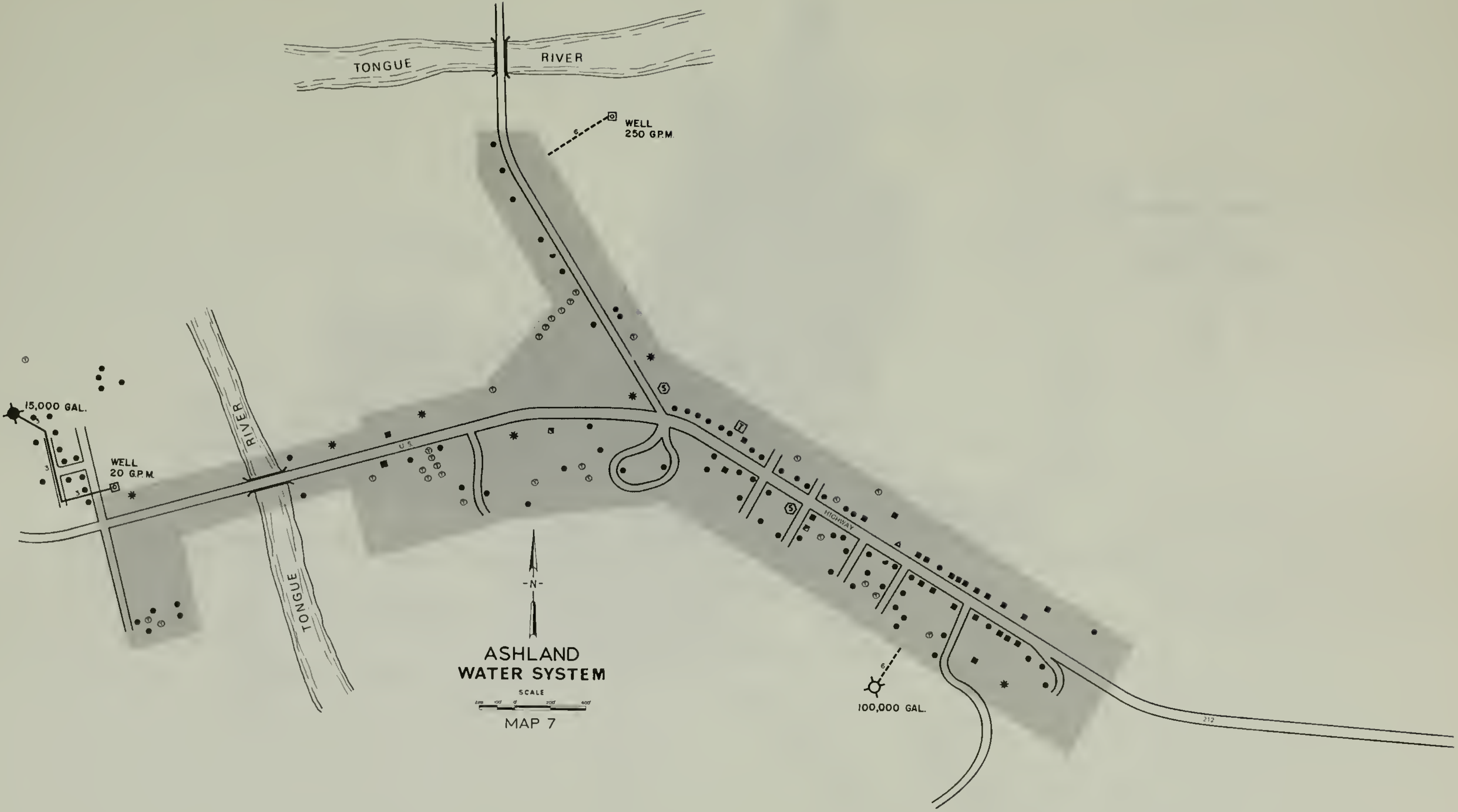


FORSYTH
WATER SYSTEM

MAP 5

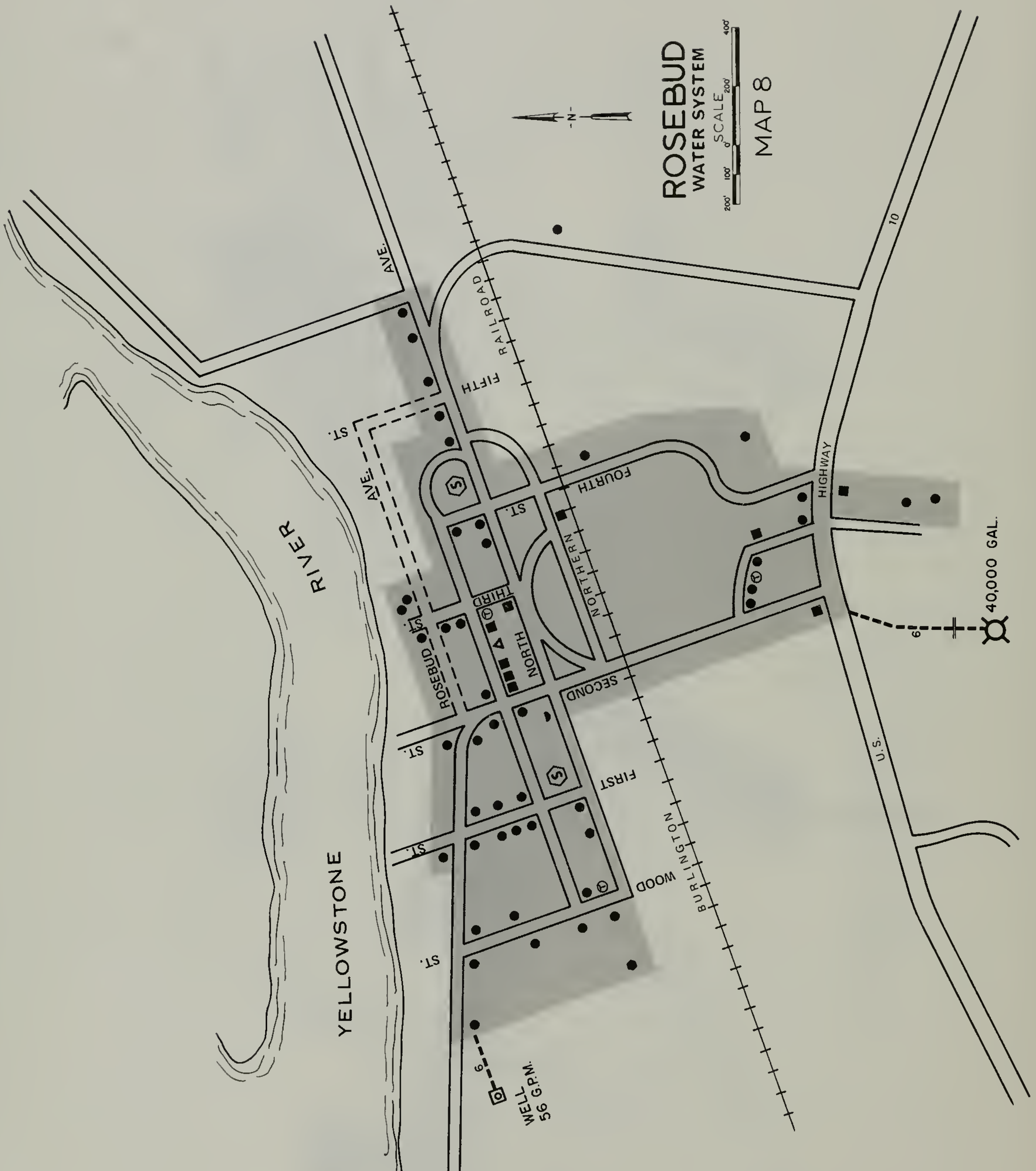


LAME DEER
WATER SYSTEM
SCALE
MAP 6



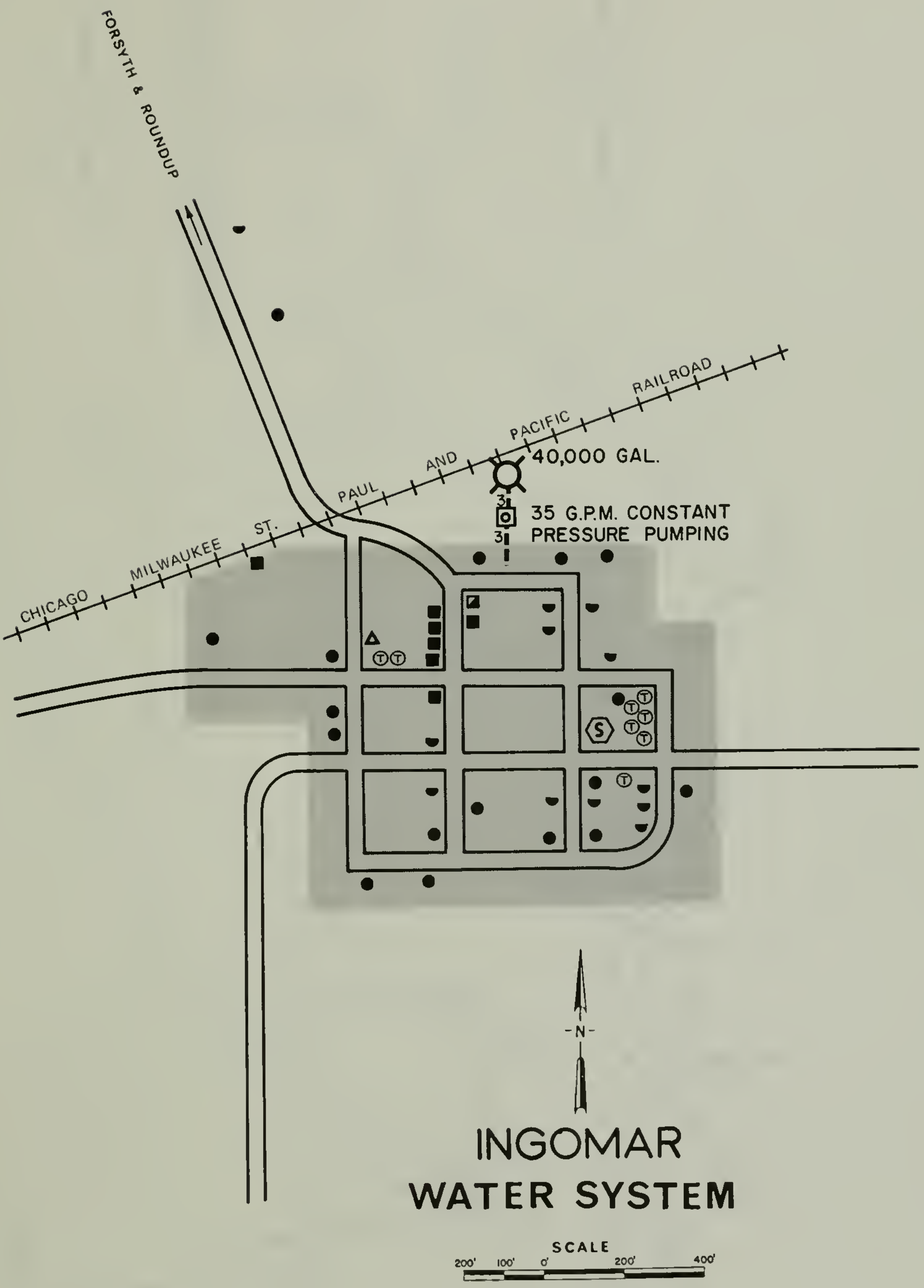
ASHLAND
WATER SYSTEM

MAP 7



ROSEBUD
WATER SYSTEM

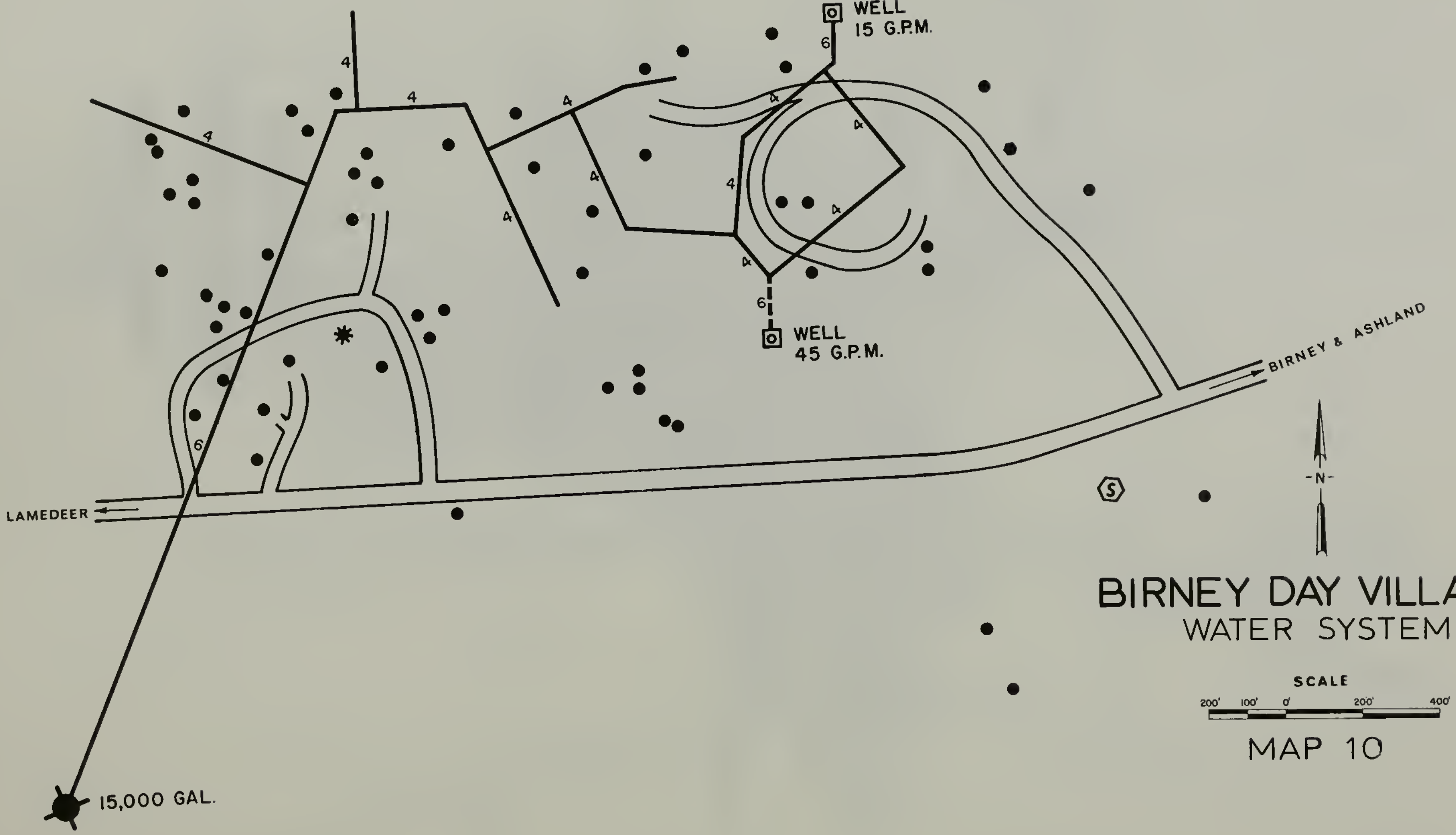
MAP 8


FORSYTH & ROUNDUP
CHICAGO MILWAUKEE ST. PAUL AND PACIFIC RAILROAD
40,000 GAL.
3
3
35 G.P.M. CONSTANT PRESSURE PUMPING
S
T
N

INGOMAR
WATER SYSTEM

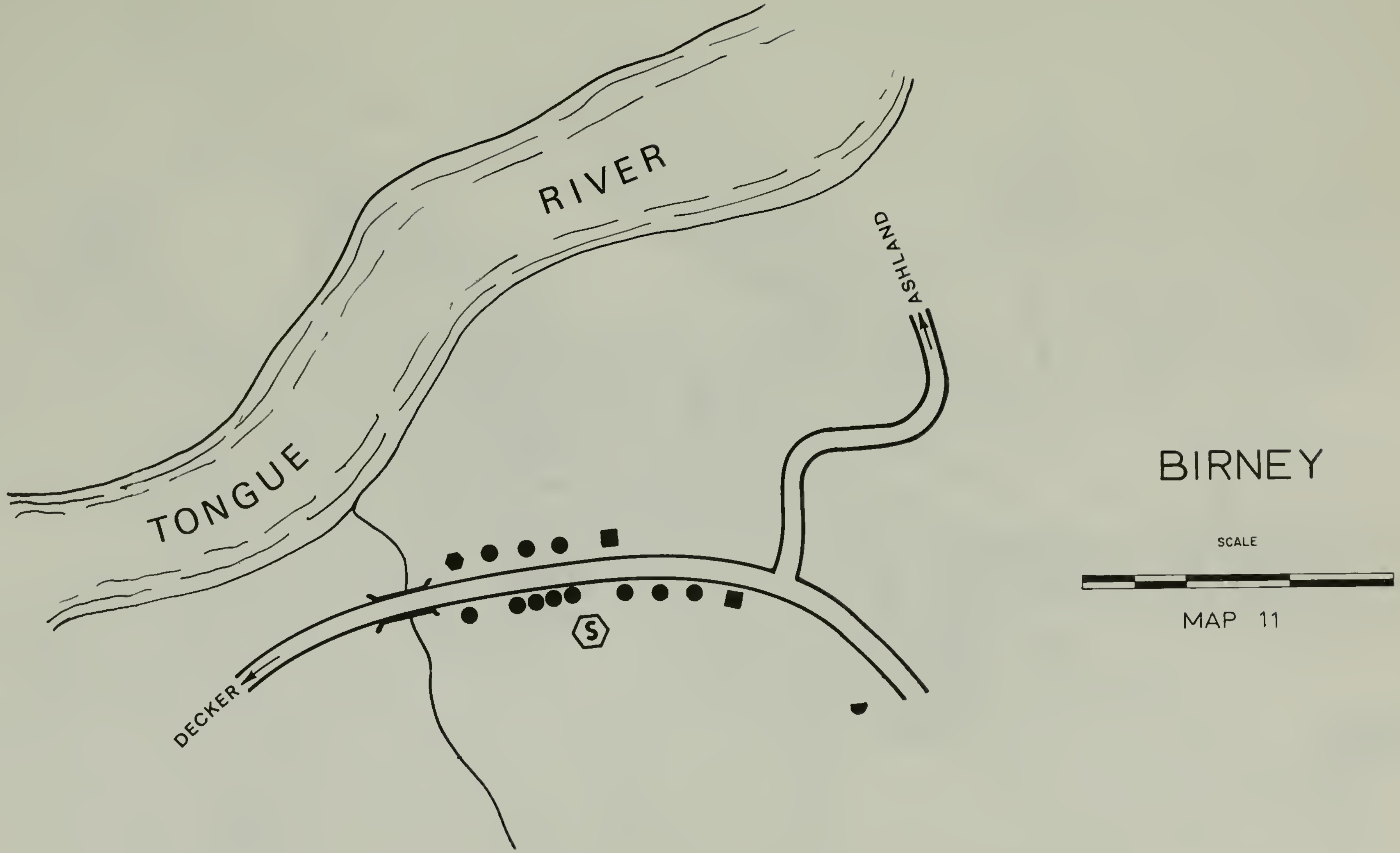
SCALE
200' 100' 0' 200' 400'

MAP 9



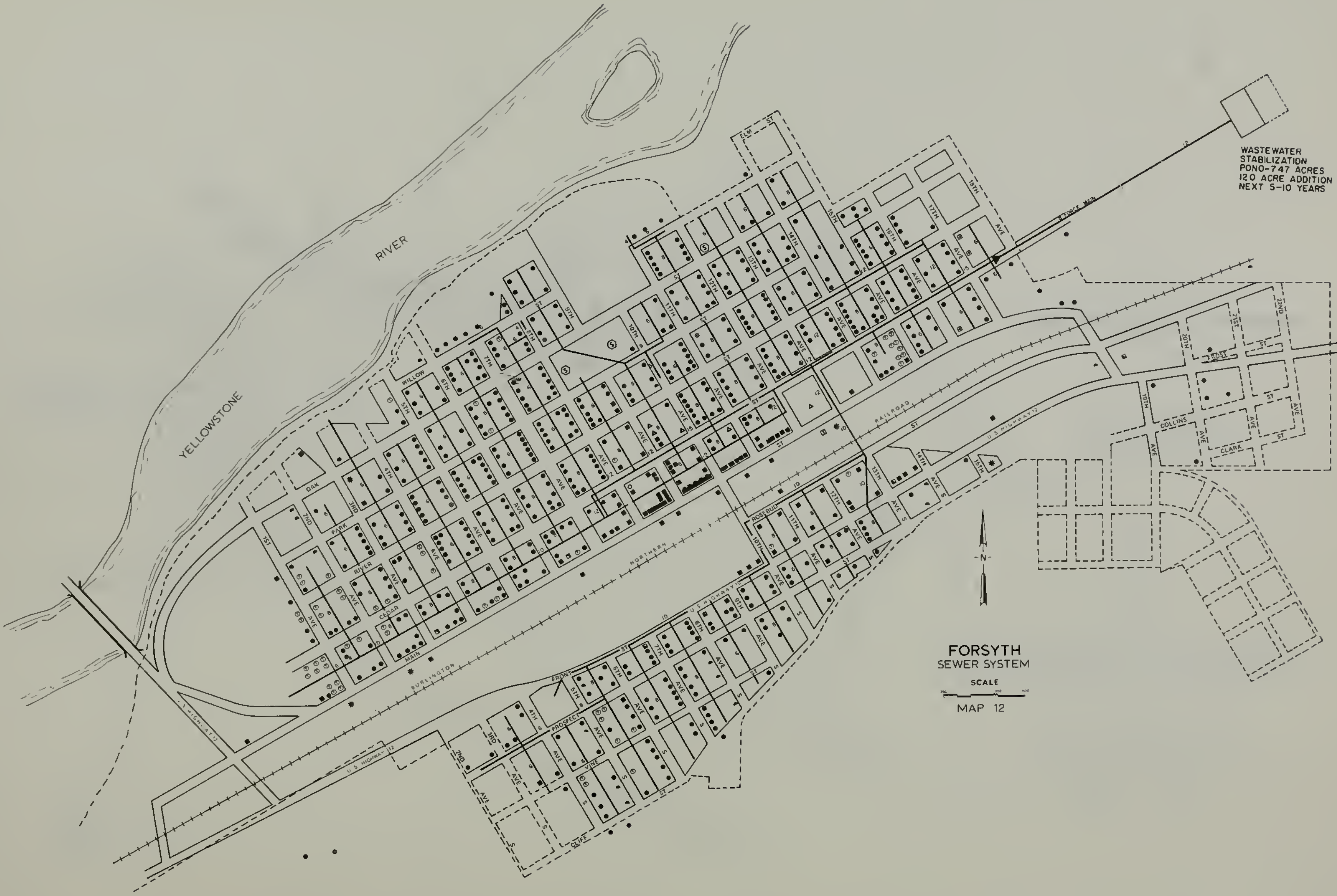
BIRNEY DAY VILLAGE
WATER SYSTEM

MAP 10



BIRNEY

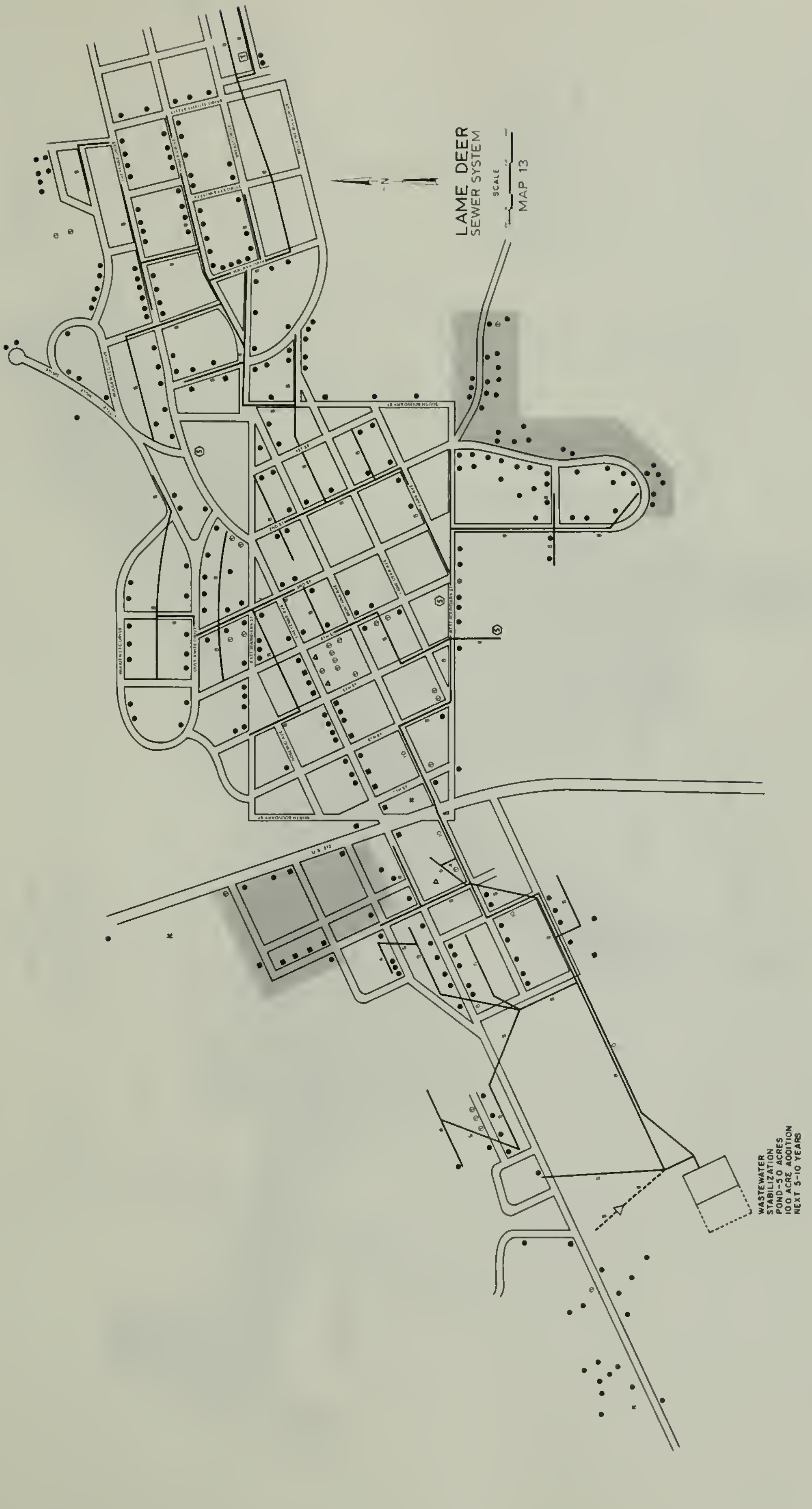
MAP 11



FORSYTH
SEWER SYSTEM

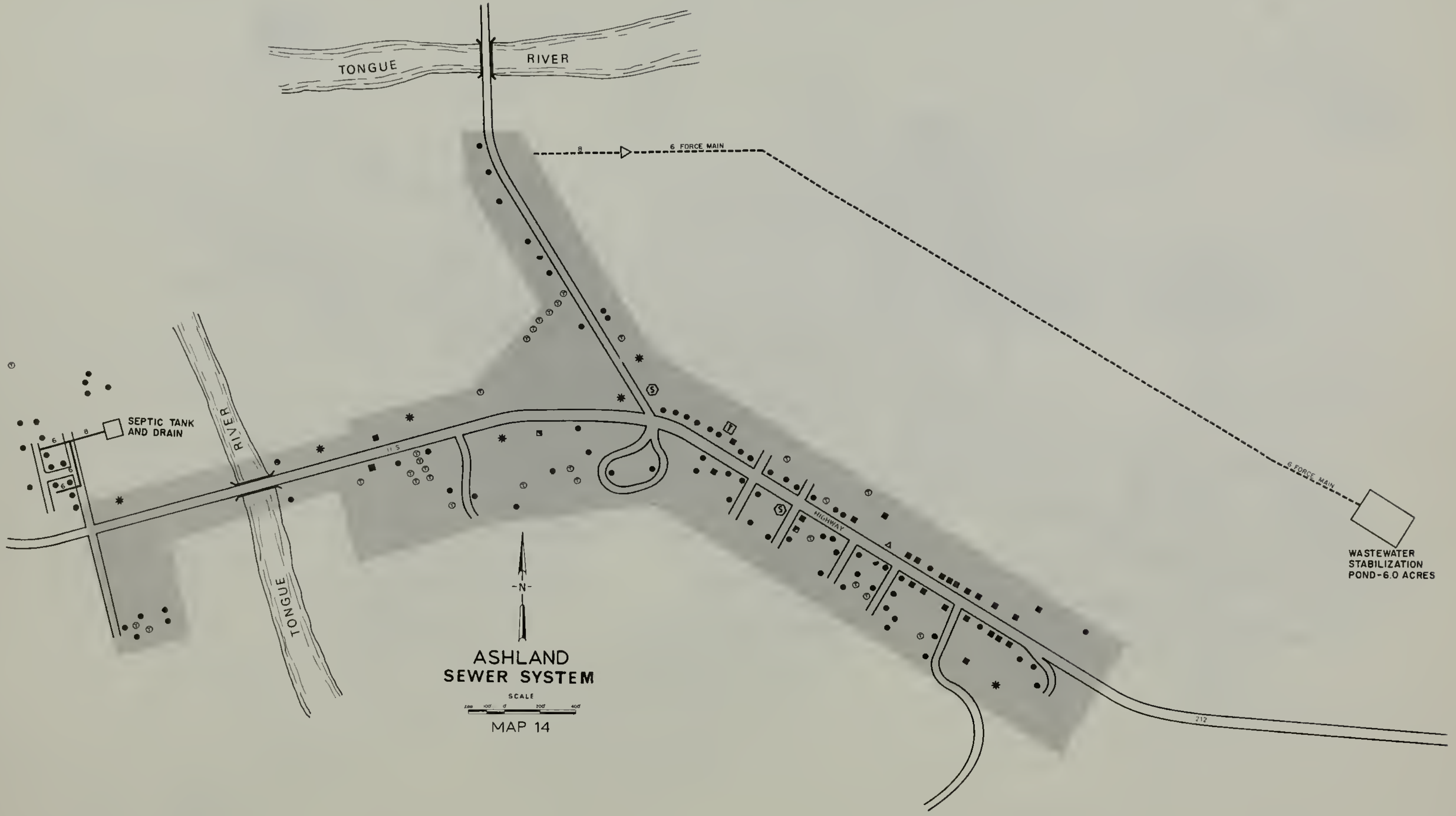
SCALE

MAP 12



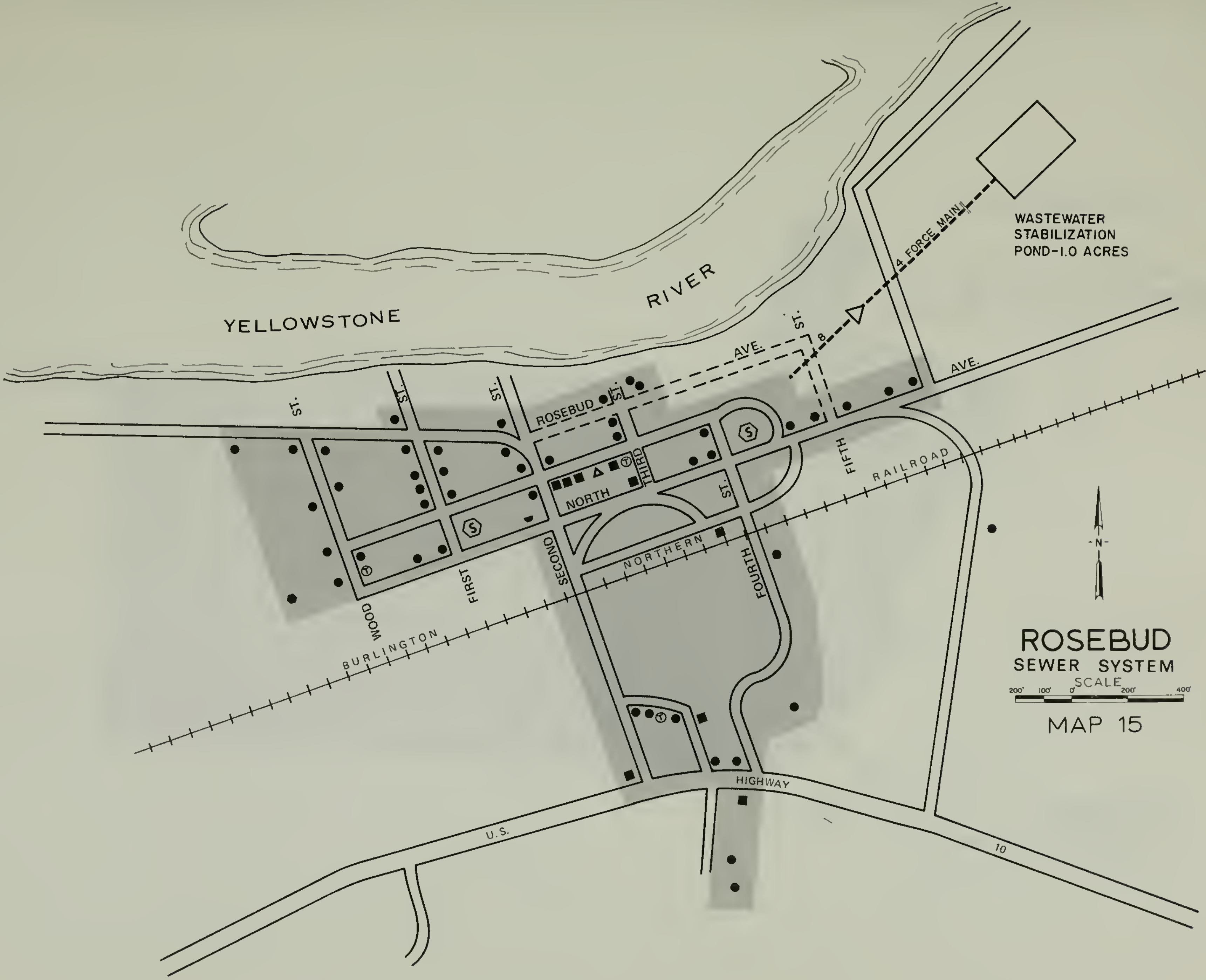
LAME DEER
SEWER SYSTEM

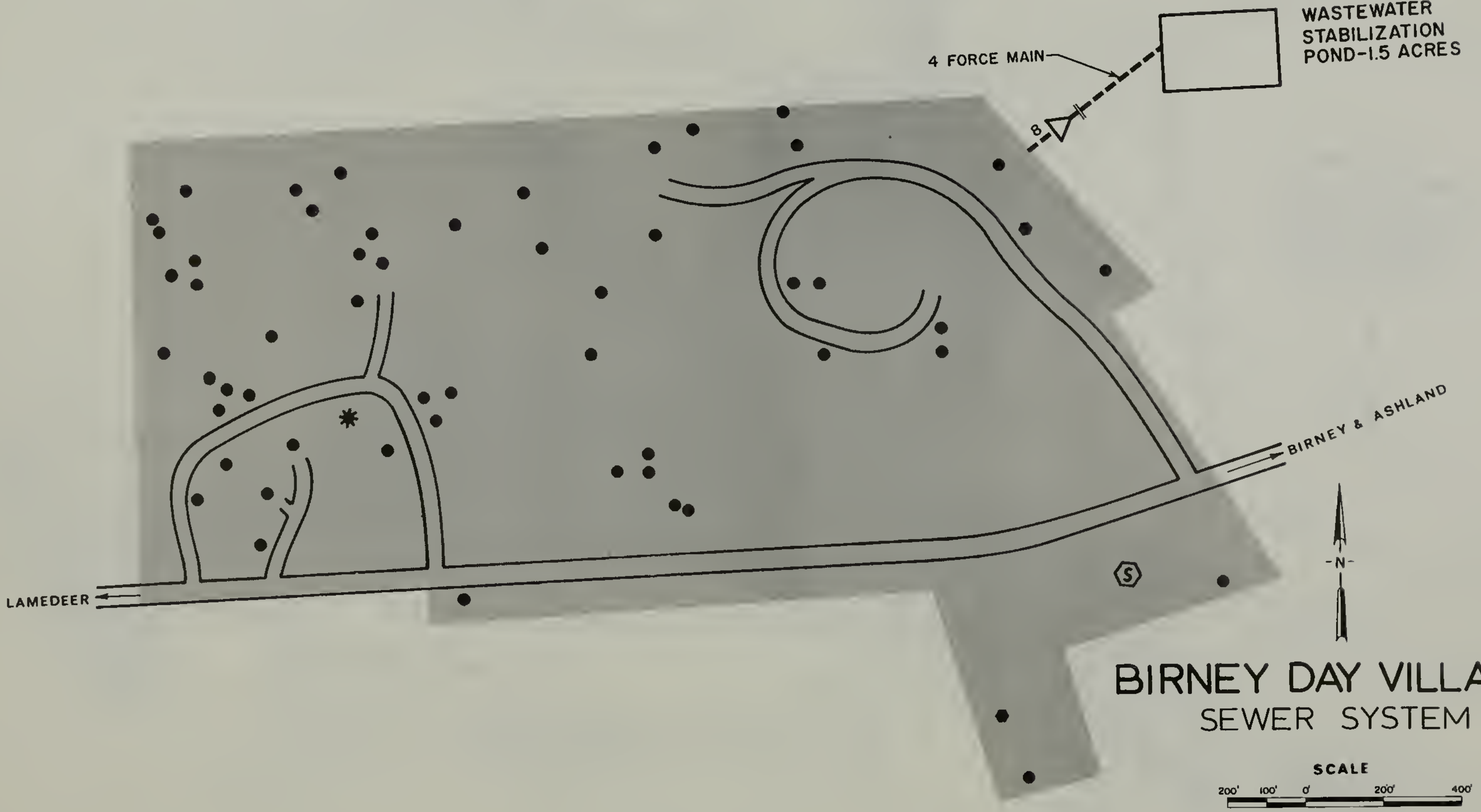
MAP 13



ASHLAND
SEWER SYSTEM

MAP 14


ROSEBUD
SEWER SYSTEM
SCALE
200' 100' 0' 200' 400'
MAP 15
-N-
WASTEWATER
STABILIZATION
POND-1.0 ACRES
4 FORCE MAIN
8
YELLOWSTONE
RIVER
ROSEBUD
AVE.
ST.
NORTH
THIRD
FIFTH
FOURTH
SECOND
FIRST
WOOD
NORTHERN
RAILROAD
BURLINGTON
HIGHWAY
U.S.
10



BIRNEY DAY VILLAGE
SEWER SYSTEM

MAP 16

APPENDICES

APPENDIX I.

MONTANA WATER LAW AND WATER QUALITY CRITERIA

SURFACE–WATER LAW

Two basic laws which concern surface-water rights are recognized in the United States. They are the Doctrine of Riparian Rights and the Doctrine of Prior Appropriation. The Doctrine of Riparian Rights originated in England and is in widespread use in the eastern United States. Basically, this doctrine gives the owners of land bordering a stream the right to have that stream flow past their land undiminished in quantity and unaltered in quality and to use it for household and livestock purposes. Under the Riparian Doctrine, the water is restricted to riparian owners, and it is unlawful for them to reduce significantly the flow of the stream.

It was determined early in the history of Montana that the Doctrine of Riparian Rights was unsuited to the conditions here. First, it was obvious that diversion and reduction of stream flow was a necessity to mining and agricultural uses, and second, much of the land in Montana was under public rather than private ownership. The Doctrine of Prior Appropriation was much more suited to the region and was formally adopted by the Montana Supreme Court in 1921. The appropriation right originated in California where the early gold miners diverted water from streams to placer-mine gold. Water rights were considered in the same manner as mining claims; those who were first in time were first in right and the quantity or size of right was determined by the amount beneficially used.

The five basic points of the Doctrine of Prior Appropriation are:

1. The use of water may be acquired by both riparian and non riparian landowners.
2. It allows diversion of water regardless of the reduction of the water supply in the stream.
3. The value of the right is determined by the priority of the appropriation, i.e., first in time is first in right.
4. The right is limited to the use of the water. Stream waters in Montana are the property of the state and the appropriator acquires only a right to their use. Moreover, this use must be beneficial.
5. A right to the use of water is considered property only in the sense that it can be bought or sold; its owner may not be deprived of it except by due process of law.

No water right may be acquired on a stream in Montana without diversion of water and its application to a beneficial use. The method of acquiring or appropriating a right to water has been outlined by the state legislature. The procedure for appropriation from an unadjudicated stream is:

1. Posting of notice in a conspicuous place at the point of intended diversion stating:
   a. quantity of water claimed
   b. use for which water is claimed and place of use
   c. description of means of diversion
   d. date of appropriation
   e. name of appropriator
2. Filing, within twenty days after date of appropriation, of a notice of appropriation with the county clerk including in addition to the posted notice:
   a. name and description of the stream
   b. description of point of diversion with reference to a permanent monument or natural marker
   c. verification by affidavit of the appropriator that facts of the notice are true

Montana laws do not require that a water user file an official record of the completion of an appropriation. It is, therefore, a fact that in many instances the demand for the water of a stream is much greater than the supply available. In such cases there is a means by which the rights and priorities of each user along a specific stream may be officially determined. The action of adjudication or water right suit may be initiated by any one or more of the appropriators. The Judge of the District Court then examines all of the claims and issues a decree establishing priority of right of each water user and the amount of water he is entitled to use.

The procedure for appropriation of water from adjudicated streams is slightly more complicated than that of unadjudicated streams. For adjudicated streams an appropriator shall:

1. Employ a competent engineer to survey the area and means of conducting water from its source to place of intended use.
2. Have aerial photographs and maps thereon to show the course of the intended diversion or location of intended impoundment.
3. File with the Clerk of the Court of the county of appropriation a petition which includes:
    a. the amount of water sought by appropriation
    b. a description of the watercourse or body from which water is intended to be appropriated
    c. a description of the means of diversion or size, location and manner of construction if a reservoir is intended
    d. the engineers survey and aerial photographs
    e. a declaration by the appropriator that the rights sought shall be subject to and bound by any decree theretofore rendered adjudicating the waters or any body to which the waters may be tributory
4. Name all others who have or appear to have rights in the source of supply as defendants in the appropriation proceeding.

Upon completion of the above procedure, a trial is held and normally a decree results. If a new appropriation is granted, the appropriator shall be bound by all prior rights and decrees.

GROUND--WATER LAW

The quantity of ground water stored beneath the surface of the earth in Montana exceeds that on the surface. For many years use of this vast ground-water resource was very limited and no need for regulating its use was deemed necessary. In recent years the use and development of ground-water resources has increased considerably and it was realized that, without some means of regulation, ground water in some areas might be withdrawn at a faster rate than it could be naturally replenished.

In 1961 the 37th Legislative Session of Montana passed a bill which created a Ground Water Code in Montana (Chapter 237, Revised Codes of Montana, 1961). This bill became law on January 1, 1962, and the State Engineer of Montana was designated as the "Administrator."

The Ground-Water Law contains many provisions which are considered pertinent to this comprehensive plan, and, therefore, portions of these provisions will be presented in this report. They are:

Section 1. Definitions or Regulations As Used In The Act.

a. "Ground Water" means any fresh water under the surface of the land including the water under the bed of any stream, lake, reservoir, or other body of surface water. Fresh water shall be deemed to be the water fit for domestic, livestock, or agricultural use. The Administrator, after a notice of hearing, is authorized to fix definite standards for determining fresh water in any controlled ground-water area or sub area of the state.

b. "Aquifer" means any underground geological structure or formation which is capable of yielding water or is capable of recharge.

c. "Well" means any artificial opening or excavation in the ground, however made, by which ground water can be obtained or through which it flows under natural pressures or is artifically withdrawn.

d. "Beneficial use" means by economically or socially justifiable withdrawal or utilizations of water.

e. "Person" means any natural person, association, partnership, corporation, municipality, irrigation district, the State of Montana, or any political sub-division or agency thereof, and the United States or any agency thereof.

f. "Administrator" means State Engineer of the State of Montana.

g. "Ground-Water area" means an area which, as nearly as known facts permit, may be designated so as to enclose a single distinct body of ground water which shall be described horizontally by surface description in all cases and which may be limited vertically by describing known geological formations, should conditions dictate this to be desirable. For purpose of administration, large ground-water areas may be divided into convenient administrative units known as "sub-areas."

Section 2. Right To Use. Rights to surface water where the date of appropriation precedes January 1, 1962, shall take priority over all prior or subsequent ground-water rights. The application of ground water to a beneficial use prior to January 1, 1962, is hereby recognized as a water right. Beneficial use shall be the extent and limit of the appropriative right. As to appropriations of ground water completed on and after January 1, 1962, any and all rights must be based upon the filing provisions hereinafter set forth, and, as between all appropriators of surface or ground water on and after January 1, 1962, the first time is first in right.

Any ground water put to beneficial use after January 1, 1962, must be filed upon in order to establish a water right thereto. Four different types of forms have been provided for filing. The titles of the forms are:

Form No. 1 "Notice of Appropriations of Ground Water"
Form No. 2 "Notice of Completion of Ground Water by Means of a Well"
Form No. 3 "Notice of Completion of Ground Water Appropriation Without a Well"
Form No. 4 "Declaration of Vested Ground Water Rights"

Form No. 1 is optional and Form No. 4 was for those who had put ground water to a beneficial use before January 1, 1962. Again, it is important to recognize that the ground-water law states especially that, "Until a notice of completion (Form No. 2 or No. 3) is filed with respect to any use of ground water instituted after January 1, 1962, no right to that use of water shall be recognized."

WATER QUALITY

The State Department of Health, under the supervision of the State Water Pollution Control Council, is responsible for administering the water pollution laws of the state. As stated in the resume of Montana water laws published by the Montana Water Resources Board, "the Department of Health has superivsion over all state waters which are directly or indirectly being used as a public water supply." The Water Pollution Control Council is responsible for classifying water and formulating a program for pollution control.

The Water Pollution Control Council has adopted specific "Water Quality Criteria;" established "Water Use Classifications;" and issued a complete list of "Policy Statements." The original adoption of these standards took place October 5, 1967, and since that time they have been made available to interested persons by the State Department of Health. A portion of the information available from the Department is the detailed chemical, physical, and biological standards of the "Water Quality Criteria" for effluent water. Water quality standards for domestic water, as set forth by the United States Public Health Service, are shown in Table A. The Montana Water Pollution Control Council "Policy Statements" and "Water Use Classifications" are presented in the following paragraphs.

The Water Pollution Control Council has added a new policy statement at the request of the Federal Water Pollution Control Administration. The new statement is:

> *Waters whose existing quality is better than the established standards as of the date on which such standards become effective will be maintained at*

the high quality unless it has been affirmatively demonstrated to the state that a change is justifiable as a result of necessary economic or social development and will not preclude present and anticipated use of such waters. Any industrial, public or private project or development which would constitute a new source of pollution or an increased source of pollution to high quality waters will be required to provide the necessary degree of waste treatment to maintain high water quality. In implementing this policy, the Secretary of the Interior will be kept advised in order to discharge his responsibilities under the Federal Water Pollution Control Act, as amended.

The originally adopted "Policy Statements" are:

1. *Quality of waters classified for multiple use shall be governed by the most stringent criteria listed for any use.*
2. *The Council has classified as "A–Closed" only those waters on which access and other activities are presently controlled by the utility owner. If other uses are permitted by the utility owner, these waters shall be reclassified "A–Open" or lower. Conversely, waters in the "A–Open" classification, if shown to meet the "A–Closed" criteria, may be so classified by the Council at the request of the utility owner.*

   Where "A–Open" water is used for swimming and other water contact sports, a higher degree of treatment may be required for potable water use.
3. *The water quality standards are subject to revision (following public hearings and, in the case of interstate streams, concurrence of the Federal Water Pollution Control Administration) as technical data, surveillance programs and technological advances make such revisions desirable. There are waters in the state on which little water quality data is presently available. Water quality criteria for these waters was established to protect existing and future water uses on the basis of the most representative information available.*

   In some cases, particularly in eastern Montana, waters have been classified "B" and "C" where the upper ends of the streams will probably be suitable for this use while the lower ends will not. However, not enough data is available to determine where the "B" and "C" designation should be dropped. Whenever a water supply or swimming area is developed, the regulations and the advice of the State Board of Health should be acquired. As time permits, data will be obtained and the classifications reviewed.
4. *As used in the Water Quality Criteria, the phrases "natural," "naturally present" and "naturally occurring" are defined as conditions or material present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil and water conservation practices have been applied. Waters below existing dams will be considered natural.*
5. *It is the intent of the criteria that the increase allowed (temperature for example) above natural conditions is the total allowable from all waste sources along the classified stream.*
6. *Although the water quality criteria specify minimum dissolved oxygen concentrations, it shall be the policy of the Council to require the best practicable treatment or control of all oxygen-consuming wastes in order to maintain dissolved oxygen in the receiving waters at the highest possible level above the specified minimums.*
7. *For treatment plant design purposes, stream flow dilution requirements shall be based on the minimum consecutive seven day average flow which may be expected to occur on the average once in ten years.*
8. *Where sampling stations and points of mixing of discharges with receiving waters as mentioned in the water quality criteria are to be established on interstate waters, the concurrence of the Federal Water Pollution Control Administration will be solicited.*

TABLE A
Water Quality Standards

Characteristic	Permissible Concentrations in Milligrams Per Liter	Objections to Concentrations Beyond Permissible Limits
Turbidity	5*	Esthetic
Color	15*	Esthetic
Threshold Odor Number	3*	Esthetic
Alkyl Benzene Sulfonate (ABS)	0.5	Taste, Foaming, Indicator of Pollution
Arsenic (As)	0.01	Toxic
Chloride (Cl)	250	Possible Laxative Effect
Copper (Cu)	1.0	Possible Physiological Effect
Carbon Chloroform Extract (CCE)	0.2	Toxicological Interest
Cyanide (CN)	0.01	Toxic
Fluoride (F)	See Below	Mottling of Teeth
Iron (Fe)	0.3	Esthetic, Staining of Laundry
Manganese (Mn)	0.05	Esthetic, Staining of Laundry
Nitrate	45	Methemoglobinemia
Phenols	0.0001	Taste
Sulfates	250	Possible Laxative Effect
Total Dissolved Solids	500	Possible Laxative Effect
Zinc (Zn)	5	Possible Laxative Effect
Radium-226	3**	Radiation Damage
Strontium-90	10**	Radiation Damage
Gross Beta Radioactivity	1,000**	Radiation Damage

Concentrations in excess of following should be re-examined before use (mg/l):

Arsenic (As)	0.05	Fluoride (F)	See Below
Barium (Ba)	1.0	Lead (Pb)	0.05
Cadmimum (Cd)	0.01	Selenium (Se)	0.01
Hexavalent Chromium (+6)	0.05	Silver (Ag)	0.05
Cyanide (CN)	0.2		

Annual Average of Maximum Daily Air Temperature	Recommended Control Limits—Fluoride Concentrations in mg/l		
	Lower	Optimum	Upper
50.0 to 53.7	0.9	1.2	1.7
53.8 to 58.3	0.8	1.1	1.5
58.4 to 63.8	0.8	1.0	1.3
63.9 to 70.6	0.7	0.9	1.2
70.7 to 79.2	0.7	0.8	1.0
79.3 to 90.5	0.6	0.7	0.8

Hardness Standards for Water

Hardness in Milligrams per Liter	Degree of Hardness
0 - 35	Soft
36 - 100	Medium
100 - 150	Hard
Over 150	Extremely Hard

* Standard Units. ** Pico-curies Per Liter.

Source: Ameen, Joseph S., Community Water Systems, 1960

9. *It is not the intent of these criteria to provide for a swimming water immediately below an existing treated domestic sewage outfall.*

10. *Where common treatment is practicable, it is the policy of the Council to restrict the number of sewer outfalls to a minimum.*

11. *Tests or analytical procedures to determine compliance with standards will, insofar as practicable and applicable, be made in accordance with the methods given in the twelfth edition of "Standard Methods for the Examination of Water and Waste Water" published by the American Public Health Association, et al., or in accordance with tests or analytical procedures that have been found to be equal or more applicable.*

12. *Because of conflicting testimony, it is the intent of the Water Pollution Control Council to obtain additional information on temperatures and fisheries on waters below existing steam generating stations at Billings and Sidney on the Yellowstone River. This can probably be best accomplished by a cooperative study between the utility, State Fish and Game Department, Federal Water Pollution Control Administration and the Montana State Department of Health.*

13. *Insufficient information is available for establishing fixed sediment criteria at this time. Until standards can be set, reasonable measures, as defined by the Water Pollution Control Council, must be taken to minimize sedimentation from man's activities.*

Minimum treatment requirements set forth by the Council are:

1. *Domestic Sewage – the minimum treatment required for domestic sewage shall be secondary treatment or its equivalent with the understanding that properly designed and operated sewage lagoons will meet this requirement.*
2. *Industrial Wastes – the minimum treatment required for industrial wastes shall be secondary treatment or its equivalent.*

Definitions of the water use classifications assigned to the Columbia and Missouri Basins and the Hudson Bay drainage in Montana are:

"A–Closed" – Water supply for drinking, culinary and food processing purposes, suitable for use after simple disinfection. Public access and activities such as livestock grazing and timber harvest should be strictly controlled under conditions prescribed by the State Board of Health.

The Council has classified as "A–Closed" only those waters on which access is presently controlled by the utility owner. If other uses are permitted by the utility owner, these waters shall be reclassified "A–Open–D_1" or lower.

"A–Open–D_1" – Water supply for drinking, culinary and food processing purposes suitable for use after simple disinfection and removal of naturally present impurities. Water quality shall also be maintained suitable for the use of these waters for bathing, swimming and recreation (See "Note" below), (where these waters are used for swimming and other water contact sports, a higher degree of treatment may be required for potable water use); growth and propagation of salmonid fishes and associated aquatic life, water fowl and furbearers; agricultural and industrial water supply. Therefore, these waters shall be held suitable for "A–Open", "C", "D", "E" and "F" uses but may not necessarily be used for all such purposes.

Note: Common sense dictates that swimming and other water contact sports are inadvisable with a reasonable distance downstream from sewage treatment facility outfalls.

Waters in this class, if shown to meet the "A–Closed" criteria, may be so classified by the Council at the request of the utility owner.

All waters within the boundaries of national parks and nationally designated wilderness, wild or primitive areas in Montana are classified "A–Open–D_1" except those adjacent to developed areas such as Snyder Creek through the community of Lake McDonald and Swiftcurrent Creek below the Many Glacier Chalet, both in Glacier National Park. Also, Georgetown, Flathead and Whitefish Lakes and Lake Mary Ronan are classified as "A–Open–D_1" as are some streams presently used for domestic water supply.

"B–D_1" The quality of these waters shall be maintained suitable for drinking, culinary and food processing purposes after adequate treatment equal to coagulation, sedimentation, filtration, disinfection and any additional treatment necessary to remove naturally present impurities; bathing, swimming, and recreation (see note under "A–Open–D_1"); growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; agricultural and industrial water supply. Therefore, "B–D_1" equals "B", "C", "D_1", "E" and "F".

"B–D_2" The quality of these waters shall be maintained suitable for the uses described for "B–D_1" waters except that the fisheries use shall be described as follows:

> *"Growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers."*

Therefore, "B–D_2" equals "B", "C", "D_2", "E" and "F".

"B–D_3" The quality of these waters shall be maintained suitable for the uses described for "B–D_1" waters except that the fisheries use shall be described as follows:

> *"Growth and propagation of non-salmonid fishes and associated acquatic life, waterfowl and furbearers."*

Therefore, "B–D_3" equals "B", "C", "D_3", "E" and "F".

"C–D_2" The quality of these waters shall be maintained suitable for bathing, swimming and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; agricultural and industrial water supply. Therefore, "C–D_2" equals "C", "D_2", "E" and "F".

"D_2" The quality of these waters shall be maintained for growth and marginal propagation of salmonid fishes and associated aquatic life, water fowl and furbearers; agricultural and industrial water supply. Therefore, "D_2" equals "D_2", "E" and "F".

"E" The quality of these waters shall be maintained for agricultural and industrial water supply uses and "E" shall equal "E" and "F" uses.

"F" The quality of these waters shall be maintained suitable for industrial water supply uses, other than food processing.

Sources:
1. "Montana Water Laws: A Resume," Inventory Series Report No. 5, Montana Water Resources Board, Helena, Montana, November, 1968
2. "Water Resources Survey," Flathead and Lincoln Counties, Montana, State Engineer's Office, Helena, Montana, June,1965
3. "Water Quality Criteria," "Water Use Classifications," "Policy Statements," communication from Claiborne W. Brinck, Director, Division of Environmental Sanitation, State Department of Health, Helena, Montana, May 7, 1968

APPENDIX II.

COMMUNITY WATER SYSTEM FACILITIES

ANALYSIS CRITERIA

Complete designs of safe community water systems can become extremely complicated. Each design and analysis is usually a unique problem for that individual system. For this study, a general approach must be used; however, it is realized that a more detailed study may result in somewhat different findings and proposals. The following paragraphs contain a discussion of the approach used in arriving at general design criteria used herein.

In the analysis and design of water systems, the interrelations of supply, transmission, storage, and distribution must be considered. For example, if the water supply is not adequate to meet the peak hourly demand, storage is necessary to provide a reserve for the peak periods. The size of the various portions of the system is determined by establishing the average daily demand on the system.

The determination of daily water consumption is arrived at by considering records of existing systems. Usage varies over a wide range of about one hundred gallons per capita per day (gpcpd) to six hundred gpcpd. Usages of four hundred gpcpd are very common during hot weather. The basis of analysis used, herein, is two hundred gpcpd average. The accepted nationwide average daily demand value for a community water system is 125 gallons per day per person for domestic use. Records show that practically all Montana communities exceed this amount especially during hot weather, and the two hundred gpcpd is more in line with present day demands for communities in Montana.

Well capacities and capacities of other sources of supply must be sufficient to provide water for the average requirements and additional amounts to sustain peak periods. It is felt that a water source capable of supplying the total average daily demand by operating for a twelve hour period is a suitable basis for analysis. This means that the average daily demand doubled, divided by twenty four hours per day and sixty minutes per hour, will result in a required rate of supply in gallons per minute. It is realized that this source may be required to operate more than twelve hours during high demand periods. This freedom in operation, combined with storage facilities, is intended to provide the necessary flexibility to handle low and high demand periods economically.

It is common practice to provide storage facilities with capacity equal to the supply necessary for one average day. This will provide storage for fire protection and any excess will add to the flexibility of the system. Table B shows desired storage for fire based on population. This information corresponds to requirements of the Montana Fire Rating Bureau and is taken from "Community Water Supplies" by Ameen.

During certain times of the year water consumption will exceed the average figure of two hundred gpcpd. The system analysis must be checked to determine the amount of water actually available to supply such demands. The estimated 1990 population is used for this check so that population increases are considered. Also, it is expected that the source will have to operate for more than the twelve hour period and any storage in excess of the recommended reserve for fire will be available for domestic consumption. The recommended storage for fire is shown in Table B.

It is considered that the source must produce water for an eighteen hour period. This value, times the well yield, results in a value for the amount of water that can be put into service per day. Also included is the storage not required for fire reserve. The sum of those two values divided by the 1990 population, yields the water available in gallons per capita per day. If water demand exceeds this amount, meters or some other means of controlling water usage must be employed. The above approximate approach results in an adequate amount of water being available and is considered to be the general analysis criteria which is applicable for all the communities studied.

Summary of Analysis Criteria

Average Daily Water Consumption (gpcpd)	200
Desired Output of System (gpcpd)	400
Desired Yield of Source (gpm)	$\frac{1.5 \text{ to } 2.0 \times \text{Average Daily Consumption}}{24 \text{ Hour/Day} \times 60 \text{ Minute/Hour}}$
Desired Storage	One Average Day's Supply

TABLE B

Desired Storage For Fire

Population	Storage (Gals.)	Population	Storage (Gals.)
200	26,800	2,200	92,800
400	33,400	2,400	99,400
600	40,000	2,600	106,000
800	46,600	2,800	112,600
1,000	53,200	3,000	119,200
1,200	59,800	3,500	135,800
1,400	66,400	4,000	152,400
1,600	73,000	4,500	169,000
1,800	79,600	5,000	185,600
2,000	86,200	5,500	202,200

Source: "Community Water Systems" by Ameen.

APPENDIX III.

COMMUNITY SEWER SYSTEM FACILITIES

ANALYSIS CRITERIA

The Montana State Department of Health has adopted the "Ten State Standards" as the criteria for the design of the various elements of the sewer system. Proposals contained herein are based on the recommendations of these standards.

Wastewater stabilization ponds are considered to be the most suitable means of sewage treatment for most smaller communities. The recommended sizes are derived from the criteria of one acre per one hundred population. This criteria is adequate if normal domestic sewage is encountered for all cases; however, more detailed study and analysis is required for final design.

Sewage collection and outfall mains are to be a minimum of eight inches in diameter according to the "Ten State Standards". This minimum is established since reasonably maintenance free systems will result. In many small communities, the sewage flow does not justify this size; however, the possibility of plugging is minimized.

Capacities for the various size lines are determined for minimum grades with the pipe flowing two thirds full and are shown in Table C. Where sewage force mains are required, a minimum of four inch pipe is proposed. Larger lines are sized according to anticipated flow.

Criteria for the sewage flows used in this study are as follows:

Average sewage flow	100 gpcpd
Peak sewage flow (laterals)	400 gpcpd
Peak sewage flow (trunk and outfall)	250 gpcpd
Treatment facilities	100 gpcpd

The nominal determination of pond size is based on the following:

$$\frac{\text{100 gpcpd x 180 day stor. x 7.5 gal/cu ft}}{\text{5--ft water depth x 43,560 sq ft/acre}} = \text{one acre per 100 people}$$

TABLE C

Average Capacity of Lines*

Pipe Diameter (inches)	Average Flow (gpm)	Population Equivalent (400 gpcpd flow)
6	110	390
8	200	720
10	320	1,150
		(250 gpcpd flow)
12	510	2,920
15	780	4,480
18	1,080	6,220
24	1,870	10,800

* Flowing two thirds full at minimum grade